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toward better environment

1969 • ANNUAL REPORT

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
U.S. DEPARTMENT OF AGRICULTURE
PORTLAND, OREGON
FOREST SERVICE
1970

The mission of the PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION is to provide the knowledge, technology, and alternatives for present and future protection, management, and use of forest, range, and related environments.

Within this overall mission, the Station conducts and stimulates research to facilitate and to accelerate progress toward the following goals:

1. Providing safe and efficient technology for inventory, protection, and use of resources.
2. Development and evaluation of alternative methods and levels of resource management.
3. Achievement of optimum sustained resource productivity consistent with maintaining a high quality forest environment.

The area of research encompasses Oregon, Washington, Alaska, and, in some cases, California, Hawaii, the Western States, and the Nation. Results of the research will be made available promptly. Project headquarters are at:

| | |
|-------------------|-----------------------|
| College, Alaska | Portland, Oregon |
| Juneau, Alaska | Roseburg, Oregon |
| Bend, Oregon | Olympia, Washington |
| Corvallis, Oregon | Seattle, Washington |
| La Grande, Oregon | Wenatchee, Washington |

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IN GENERAL

1969 was the year "ecology" and "environment" became household words in America as more and more people voiced deep-seated dissatisfaction with the sight, sound, and smell of their surroundings.

But ecology and environment, which deal with the relationships between living organisms and their surroundings, are not new to forest, range, and watershed researchers. They have been bywords of these scientists for decades — in use before the Forest Service launched its research program in the Pacific Northwest at Wind River, Washington, in 1912.

Almost all the Station's research can be traced to a concern with ecology and the environment. In addition, many of the results can and do aid in finding ways to reduce pollution and to help in maintaining or improving the quality of air, water, soil, solitude, natural beauty, and other factors of our environment.

For example, research pointed out that clear-cutting in southeast Alaska need not damage the quality of salmon streams when logging is carefully done; that use of diammonium phosphate, a popular fire retardant, can result in the production of alarmingly high levels of carbon monoxide and hydrocarbons which could affect fire control personnel; and that, when properly used, brush control chemicals such as 2,4-D, amitrol, 2,4,5-T, and picloram need not reduce the quality of the forest environment.

Studies of outdoor recreation, scenic resources, and visitor center facilities likewise produced some new facts and useful clues. One of such was the apparent interest found in the social aspects of camping versus the more traditional idea that campers seek mainly isolation and the beauty of nature. New methods of identifying, inventorying, and computerizing scenic problems and opportunities were developed; and we found that adults often avoid visitor information center exhibits which have tests that might show them to be wrong.

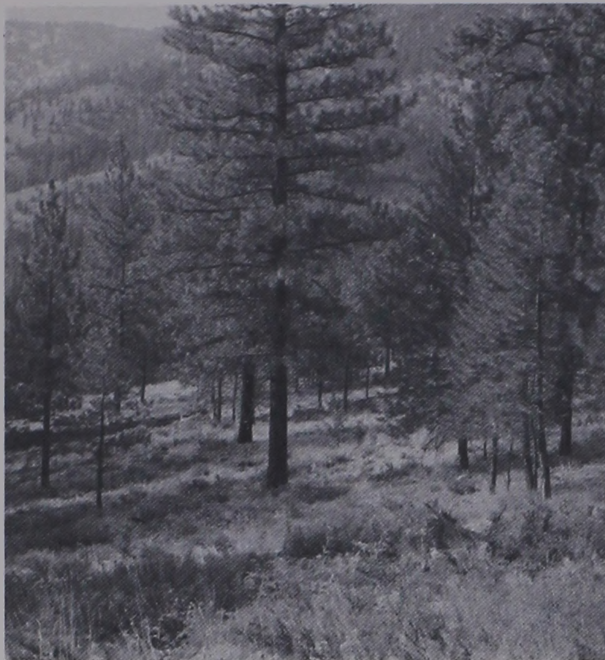
Some studies probed protectors, products, and chemical constituents of forest trees. Northwest forests are found to produce an astonishing array of subterranean-fruited fungi, including truffles, which form mycorrhizae and thus protect tree rootlets from diseases. New methods for estimating veneer losses in manufacturing were developed; these will be helpful in both plywood production and timber appraisals. Scientists found that different genotypes of Douglas-fir seedlings are not equally preferred for browse by deer, and follow-up tests indicate that variation in chemical composition may be the reason. This knowledge may lead to the use of components of essential oils as safe, chemical protectants of trees against deer browsing.

Other researchers investigated such diverse subjects as shrub growth, biological insect control, and advance road construction. For example, heavy grazing of bitterbrush stimulated the plant's shoot growth but apparently shortened its lifespan. As a result, moderate grazing produced double the forage per acre compared with heavy grazing. Electron microscope studies, part of intensive research to assure complete safety of an insect-killing virus, led to the discovery of a second virus useful in control of the Douglas-fir tussock moth. The study of road construction rates showed that further acceleration of advance roading on the Umpqua National Forest is not justifiable from an economic standpoint under present cost-return rates.

The Station's findings, mainly research results incorporated into firm recommendations ready for use, were issued in 184 publications. A weekly 5-minute radio program was instituted to better inform people about research and applications that can be made to solve ecological and environmental problems. It is broadcast throughout Oregon, Washington, and Alaska on 45 stations from KICY in Nome, Alaska, to Ashland, Oregon's KWIN.

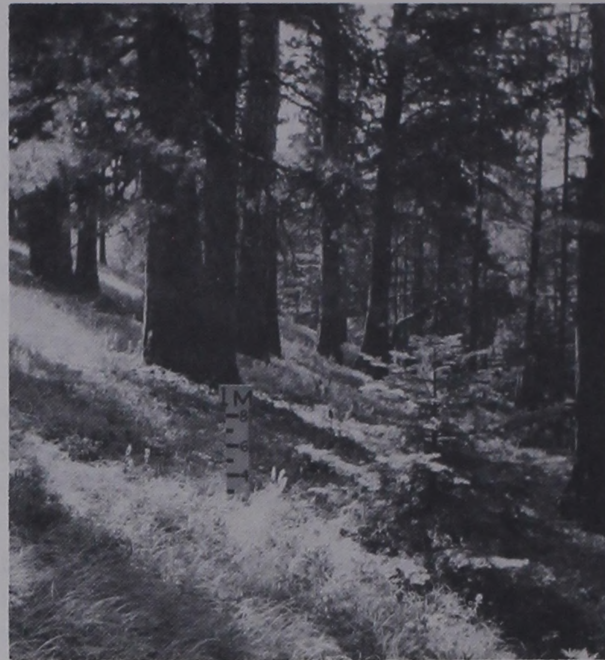
One new research work unit — Aerial Application of Biological Agents and Other Materials for

Research Natural Areas



Wolf Creek Research Natural Area

Ponderosa pine/bitterbrush/wheatgrass at 3,500 feet in Okanogan National Forest.



Pataha Bunchgrass Research Natural Area

Ponderosa pine/spiraea/pinegrass at lower elevations in Umatilla National Forest.

At present there are 41 Research Natural Areas in Oregon and Washington covering 27,254 acres; and, as of 1968, there were 12 in Alaska covering 220,308 acres. The Areas are managed by four Federal agencies: Forest Service, Bureau of Land Management, Bureau of Sport Fisheries and Wildlife, and National Park Service.

Pictured on this page and page 6 are some recent photos of a few Research Natural Areas under Forest Service management.



Rainbow Creek Research Natural Area

White pine/white fir at slope bottom in Umatilla National Forest.

Forest Insect Control — was started at Corvallis. Its mission is to develop new technology for safe and efficient application of insecticides. The unit will serve as a tie-in between (1) the insecticide screening research unit at Berkeley, California, (2) the Equipment Development Center at Missoula, Montana, and (3) two projects at Corvallis — Behavior and Impact of Forest Chemicals and Diseases of Western Forest Insects.

A few noteworthy changes in staff occurred at the Station during 1969.

Dr. Ching Yan Li, microbiologist, came to the Corvallis Forestry Sciences Laboratory as a member of the Western Root Diseases and Soil Microbiology research unit. Dr. Li, a native of Taiwan, received his Ph.D. from Oregon State University in 1969. His special interests are soil microbiology and biochemistry of phenolics and other fungitoxic plant products. He is studying microbial or plant-produced fungitoxins in forest soils and tree roots and their relationships to tree root diseases.

Dr. Peyton W. (Pete) Owston replaced **Dr. Kenneth Krueger** (deceased) in Seeding, Planting, and Nursery Practice research at Corvallis. Dr. Owston transferred from the Berkeley Station. He is seeking ways to minimize water stress in tree seedlings during lifting from the nursery, transport to the forest, and early growth under drought conditions.

Dr. Ronald E. Stewart, Forest Ecologist, from Oregon State University, joined the Station's research unit at Roseburg, Oregon. Stewart's assignment strengthens the search for safe, effective, and economical methods for reclaiming brushfields, releasing suppressed conifers from overstory brush and weed trees, and preventing unwanted brush establishment on new cuttings.

Dr. Kenneth W. Seidel joined the staff at the Silviculture Laboratory, Bend, Oregon, developing improved practices for increasing timber yields in eastern Oregon and Washington. Seidel conducted similar research for 11 years with the North Central Forest Experiment Station in the Missouri Ozarks.

Dr. Arthur R. Tiedemann joined the Water Yield and Erosion research unit at Wenatchee, a multidisciplinary team attacking problems of soil stability and rehabilitation of deteriorated watersheds east of the Cascades. A 1969 graduate in range ecology, Tiedemann came to us from the University of Arizona.

The staff of the Forest Engineering Systems unit at Seattle now includes **Penn A. Peters**, aerospace engineer. He is studying the aerodynamics of tethered balloons for logging and the feasibility of new logging techniques. Peters trained at the University of Minnesota and the University of Washington.

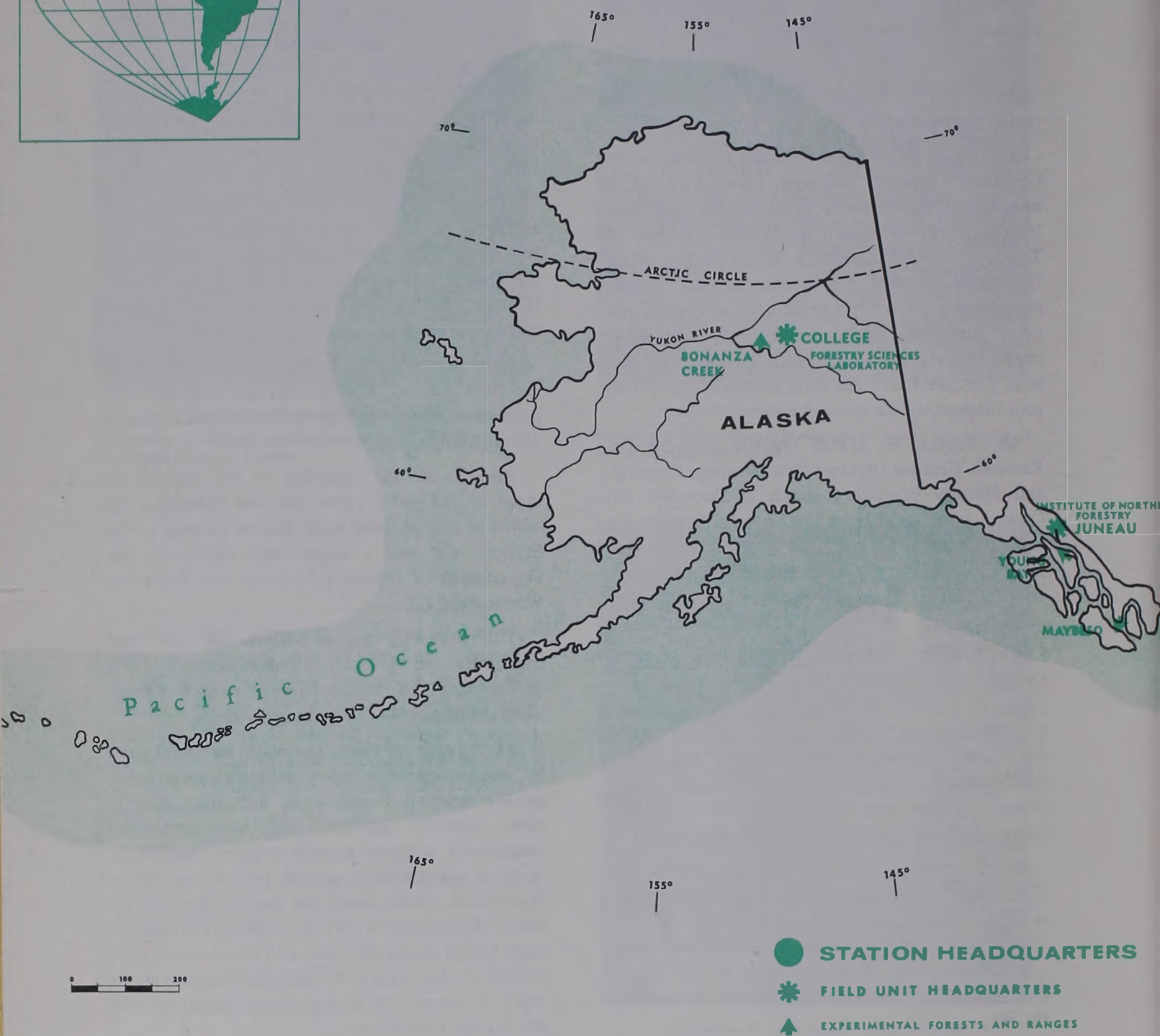
William G. Morris, forest fuels scientist and author of over 50 scientific publications on forest fire danger, detection, and control, retired from the Station in November after 39 years of service. He was a member of the Fuel Appraisal Systems research project at Seattle.

Near the year's end, **Mrs. Edith P. Tomkins**, Assistant Editor, retired after an extensive and productive career in Forest Service research and administration.

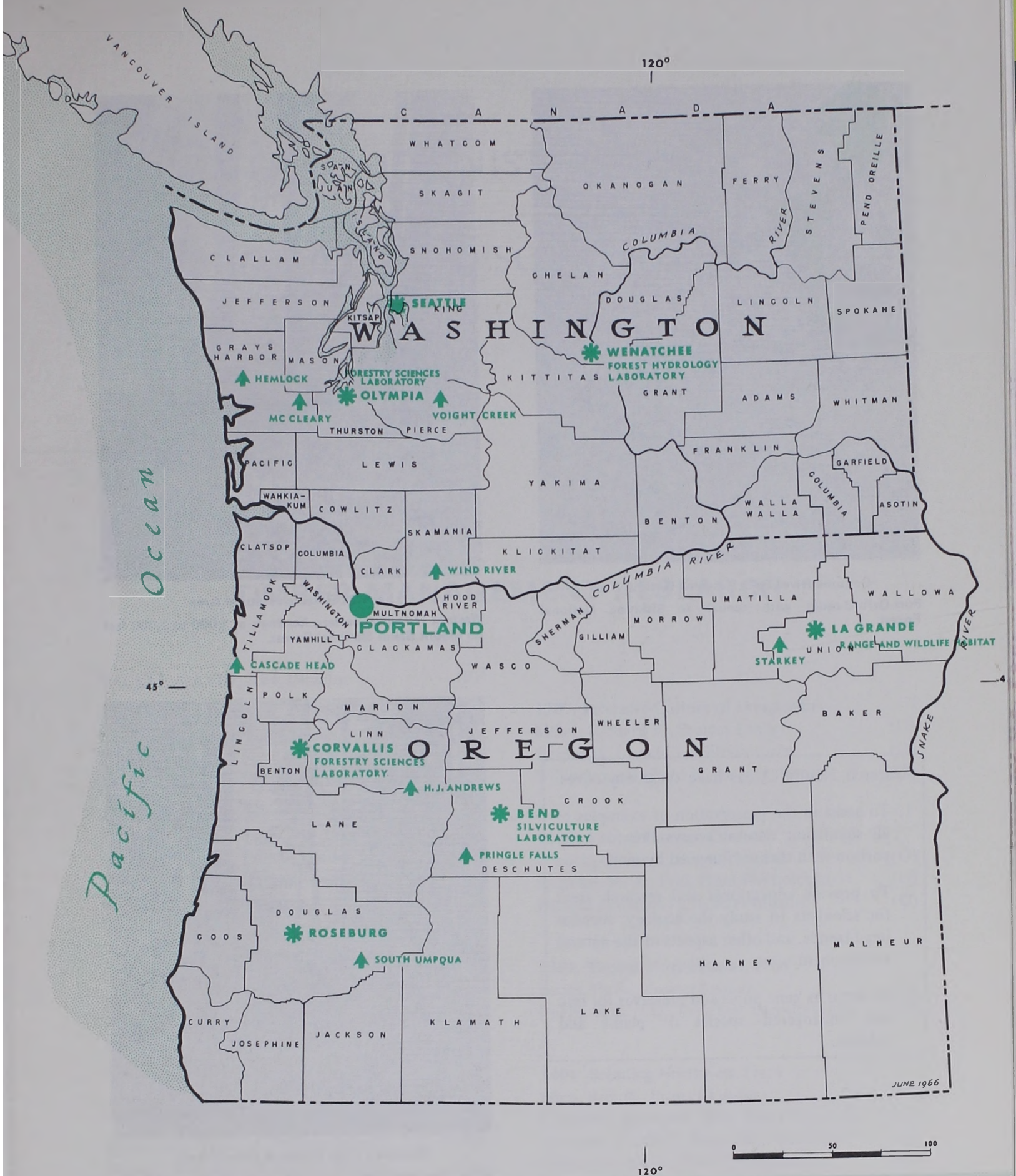
Because of the doubling of the manuscript input in the past 3 years, **Mrs. Jan Etheridge** was added to the editorial staff. Before coming to the Station, she was a supervisory editor for the Department of Health, Education, and Welfare in Washington, D.C.

The following pages outline the staff and organization of the Station and show the location of the main U.S. Forest Service research installations in Oregon, Washington, and Alaska.

As in previous years, our work was conducted in cooperation with many others — universities, private research foundations, industries, government resource agencies, and with individual consultants covering a wide range of disciplines. Some of the resulting research progress of 1969 is highlighted. More detail on these and other research developments may be found in the publications issued during the year and listed in the final section of this report. We welcome inquiries about any of these as well as suggestions on any part of the Station's activities.

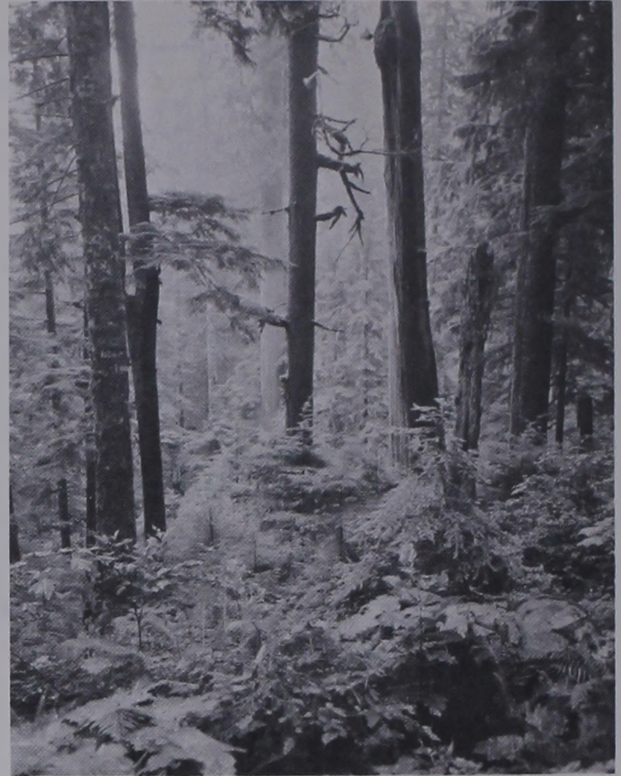


PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION





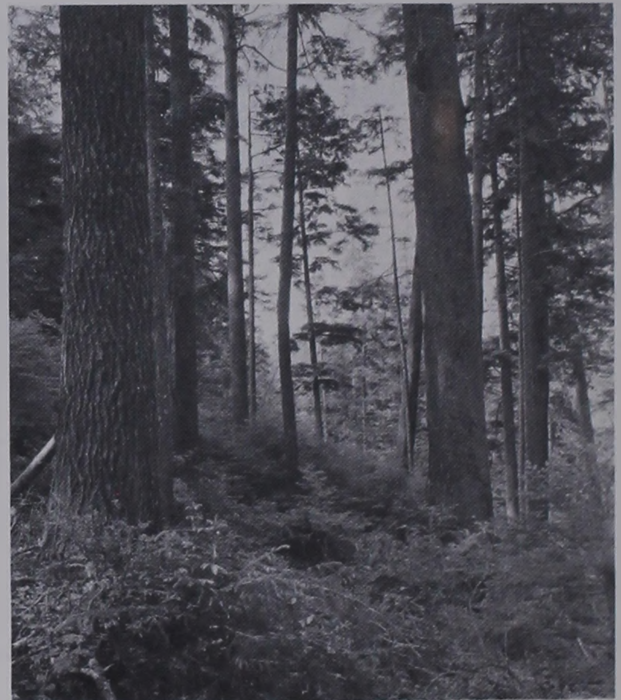
Coquille River Falls Research Natural Area
Port-Orford-cedar with tanoak in Siskiyou National Forest.



Lake 22 Research Natural Area
Western redcedar/western hemlock at 1,000 to 2,000 feet on Mount Baker National Forest.

Research Natural Areas have these objectives:

1. To assist in the preservation of examples of all significant natural ecosystems for comparison with those influenced by man.
2. To provide educational and research areas for scientists to study the ecology, successional trends, and other aspects of the natural environment.
3. To serve as gene pools and preserves for rare and endangered species of plants and animals.



Neskowin Crest Research Natural Area
Sitka spruce/western hemlock near ocean on Siuslaw National Forest.

STATION ADMINISTRATION STAFF

PROJECTS AND SCIENTISTS--1969

PHILIP A. BRIEGLEB, Director

TIMBER MANAGEMENT RESEARCH

TACKLE, DAVID, Asst. Director (P)¹

1201 Seeding, Planting, and Nursery Practice

Stein, William I., Project Leader (P)

Edgren, James W., Plant Ecologist (P)

Owston, Peyton W., Plant Physiologist (C)

1203 Culture of Coniferous Forests, Interior PNW

Dahms, Walter G., Project Leader (B)

Barrett, James W., Silviculturist (B)

Cochran, Patrick H., Soil Scientist (B)

Seidel, Kenneth W., Research Forester (B)

1204 Culture of Mixed-Conifer Forests, West-Side Cascades

Ruth, Robert H., Project Leader (C)

Franklin, Jerry F., Principal Plant Ecologist (C)

Herman, Francis R., Mensurationist (C)

Minore, Don, Plant Ecologist (C)

1206 Brushfield Reclamation, Prevention and Ecology

Gratkowski, Henry J., Project Leader (R)

Stewart, Ronald E., Research Forester (R)

1207 Intensive Culture of Douglas-fir

Miller, Richard E., Project Leader (O)

Reukema, Donald L., Silviculturist (O)

Williamson, Richard L., Mensurationist (O)

1208 Animal Damage Control

Crouch, Glenn L., Project Leader (O)

Radwan, M. A., Prin. Plant Physiologist (O)

Dimock, Edward J., II, Silviculturist (O)

1301 Timber Measurement, PNW

Bruce, David, Project Leader (P)

Curtis, Robert O., Principal Mensurationist (P)

1401 Breeding Northwest Trees

Silen, Roy R., Project Leader (C)

Campbell, Robert K., Prin. Plant Geneticist (C)

Sorensen, Frank C., Prin. Plant Geneticist (C)

Copes, Donald L., Plant Geneticist (C)

FOREST ENVIRONMENT RESEARCH

HARRIS, ROBERT W., Asst. Director (P)

1601 Water Yield and Erosion

Berndt, Herbert W., Project Leader (W)
 Fowler, William B., Meteorologist (W)
 Herring, Harold G., Hydrologist (W)
 Klock, Glen O., Soil Scientist (W)
 Lopushinsky, William, Plant Physiologist (W)
 Tiedemann, Arthur R., Range Scientist (W)

1602 Soil Stability and Streamflow

Rothacher, Jack S., Project Leader (C)
 Dyrness, C. Theodore, Prin. Soil Scientist (C)
 Fredriksen, Richard L., Soil Scientist (C)

1603 Behavior and Impact of Forest Chemicals

Tarrant, Robert F., Project Leader (C)
 Bollen, Walter B., Prin. Soil Microbiologist (C)
 Moore, Duane G., Soil Scientist (C)
 Norris, Logan A., Chemist (C)

1701 Range Environmental Management

Garrison, George A., Project Leader (L)
 Geist, Jon M., Soil Scientist (L)
 Strickler, Gerald S., Plant Ecologist (L)

1801 Big-Game Habitat

Smith, Justin G., Project Leader (L)
 McConnell, Burt R., Plant Ecologist (L)
 Dealy, J. Edward, Assoc. Plant Ecologist (L)
 Edgerton, Paul J., Assoc. Plant Ecologist (L)

1901 Wildland Recreation

Hendee, John C., Project Leader (S)

1902 Cooperative Forest Recreation, University of Washington

Wagar, J. Alan, Project Leader (S)

FOREST PROTECTION RESEARCH

WRIGHT, KENNETH H., Asst. Director (P)

2103 Fuel Appraisal

Fahnestock, George R., Project Leader (S)
 Lund, Herluf G., Assoc. Photogrammetrist (S)

2105 Cooperative Forest Fire Science, University of Washington

Murphy, James L., Project Leader (S)

2201 Forest Insects of the Pacific Northwest

Wickman, Boyd E., Project Leader (C)
 Mitchell, Russel G., Prin. Insect Ecologist (C)
 Mason, Richard R., Insect Ecologist (C)
 Sartwell, Charles, Jr., Assoc. Insect Ecologist (C)

2203 Diseases of Western Forest Insects

Thompson, Clarence G., Project Leader (C)
 Martignoni, Mauro E., Prin. Microbiologist (C)
 Maksymiuk, Bohdan, Prin. Entomologist (C)
 Hughes, Kenneth M., Assoc. Entomologist (C)

2204 Nutrition and Behavior of

Forest Insects – PNW

Carolin, Valentine M., Jr., Project Leader (P)
 Daterman, Gary E., Entomologist (C)
 Ryan, Roger B., Entomologist (C)
 Schmidt, Fred H., Entomologist (C)
 Coulter, William K., Assoc. Entomologist (P)

2301 Forest Diseases of the Pacific Northwest

Shea, Keith R., Project Leader (C)
 Aho, Paul E., Plant Pathologist (C)
 Harvey, George M., Plant Pathologist (C)
 Knutson, Donald M., Plant Pathologist (C)

2302 Western Root Diseases and Soil Microbiology

Trappe, James M., Project Leader (C)
 Lu, Kuo C., Principal Microbiologist (C)
 Nelson, Earl E., Principal Plant Pathologist (C)
 Zak, Bratislav, Principal Plant Pathologist (C)
 Li, Chiang Y., Assoc. Microbiologist (C)

FOREST SURVEY, FOREST ECONOMICS, FOREST PRODUCTS, MARKETING AND UTILIZATION, AND ENGINEERING RESEARCH

FLORA, DONALD F., Asst. Director (P)

3101 Grade and Quality of Western Timber
Lane, Paul H., Project Leader (P)
Henley, John W., Wood Technologist (P)
Woodfin, Richard O., Jr., Wood Technologist (P)
Plank, Marlin E., Assoc. Wood Technologist (P)
Pong, Wee Yuey, Assoc. Wood Technologist (P)

3602 Wood Construction and Use Concepts
Grantham, John B., Project Leader (S)
Heebink, Thomas B., Prin. Research Engineer (S)
Oviatt, Alfred E., Jr., Prin. Research Architect (S)

3701 Forest Engineering Systems
Lysons, Hilton H., Project Leader (S)
Peters, Penn A., Prin. Aerospace Engineer (S)
Carson, Ward W., Mechanical Engineer (S)
Mann, Charles N., Mechanical Engineer (S)
Vigna, Carl P., Designer (S)

4101 Forest Survey – Pacific Coast
Metcalf, Melvin E., Project Leader (P)
Gedney, Donald R., Resource Analyst (P)
Berger, John M., Mensurationist (P)
Bolsinger, Charles L., Assoc. Mensurationist (P)
Oswald, Daniel D., Assoc. Resource Analyst (BC)
Wall, Bryan R., Assoc. Economist (P)

4102 Forest Survey Techniques – PNW
Pope, Robert B., Project Leader (P)
MacLean, Colin D., Mensurationist (P)

4201 Economic Evaluation of Forestry Opportunities
Schallau, Con H., Project Leader (P)
Schweitzer, Dennis L., Principal Economist (P)
Randall, Robert, Assoc. Economist (P)
Sassaman, Robert W., Assoc. Economist (P)

4301 Marketing Economics Research
Hamilton, Thomas E., Acting Project Leader (P)
Adams, Thomas C., Principal Economist (P)
Austin, John W., Assoc. Research Forester (P)

BIOMETRICS

JOHNSON, FLOYD A., Principal Biometrician (P)

Hazard, John W., Biometrician (P)

RESEARCH SUPPORT SERVICES

PETERSEN, CHAS. J., Asst. Director (P)
Calvert, Lorne M., Operations (P)
Martin, Dorothy E.,
Programing and Statistics (P)

Newlon, Charles J., Research Information (P)
Knutson, Maurice C., Library (P)
Hansen, George M., Publications (P)
DiBenedetto, A. P., Architecture/Engineering (P)

INSTITUTE OF NORTHERN FORESTRY

HURD, RICHARD M., Director (J)

1210 Culture of Coastal Forests – Alaska

Harris, Arland S., Project Leader (J)

Farr, Wilbur A., Assoc. Research Forester (J)

1211 Ecology of Subarctic Trees and Forests

Viereck, Leslie A., Project Leader (CA)

Zasada, John C., Research Forester (CA)

1604 Erosion and Sediment Reduction – Alaska Coastal Forests

Helmets, Austin E., Project Leader (J)

Meehan, William R., Fishery Biologist (J)

Swanston, Douglas N., Assoc. Geologist (J)

2106 Fire Control Methods – Alaska

Barney, Richard J., Project Leader (CA)

Noste, Nonan V., Assoc. Research Forester (CA)

2206 Forest Insects – Coastal Alaska

Schmiege, Donald C., Project Leader (J)

Hard, John S., Entomologist (J)

Torgersen, Torolf R., Entomologist (J)

2207 Forest Insects – Interior Alaska

Beckwith, LeRoy C., Project Leader (CA)

4103 Forest Survey – Alaska

Hutchison, O. Keith, Project Leader (J)

Hegg, Karl M., Assoc. Research Forester (J)

LaBau, Vernon J., Assoc. Research Forester (J)

Laurent, Thomas H., Assoc. Research Forester (J)

-
- ¹(P) Portland, Oregon
 - (C) Corvallis, Oregon
 - (B) Bend, Oregon
 - (W) Wenatchee, Washington
 - (O) Olympia, Washington
 - (L) La Grande, Oregon
 - (R) Roseburg, Oregon
 - (S) Seattle, Washington
 - (BC) Berkeley, California
 - (J) Juneau, Alaska
 - (CA) College, Alaska

SOME HIGHLIGHTS OF 1969 DEVELOPMENTS

BIOLOGICAL CONTROLS

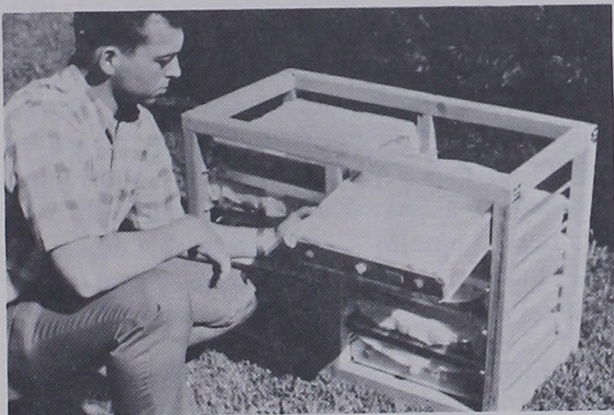
(Publications on page 37)

Parasites Against European Pine Shoot Moth

The European pine shoot moth, sometimes found on ornamental pines in western Oregon and Washington, is a potential pest of western pine forests. Our shoot moth research has been aimed at control during the adult stage, by sex attractants, but reduction of the population during earlier life stages is needed to get maximum effect from the sex attractant method.

In the spring, we tested an inundative release of a native pupal parasite, *Itoplectis quadricingulatus* (Prov.), as a means of preliminary reduction of the shoot moth population. Over a 6-week period, a total of 5,365 female parasite adults, previously

exposed to males, was liberated in an ornamental planting at McNary Dam. Results indicated that at least 25 percent of the shoot moth pupae were killed by parasite progeny and an estimated 5 percent by adult parasites feeding on the pupae. Because of abnormally high diurnal temperatures in the test area, very few parasite progeny survived to join the attack by released adults on shoot moth pupae. Under normal temperatures, increased mortality of shoot moth pupae can be expected, and the parasites should exert more effective control of the moths. Further tests are needed to tell.



Cages used to transport parasites (*Itoplectis quadricingulatus*) from laboratory to field for release against European pine shoot moth.



Released female parasite (*Itoplectis quadricingulatus*) searching pine terminals for pupae of European pine shoot moth.

Viruses Against Douglas-fir Tussock Moth

Methods have been developed for utilizing an insect-killing virus to control the Douglas-fir tussock moth, a serious pest of Douglas-fir and true firs in western forests. Research involving electron microscope studies of the virus showed that actually two viruses were involved. The two

viruses appear to be infectious only for the Douglas-fir tussock moth and closely related tussock moth species. While extensive testing has demonstrated the safety of the two viruses to man and wildlife (including beneficial insects), it is essential that spray formulations for field use contain only the insect pathogens specified.

The discovery of the mixed virus infection in the tussock moth is the result of intensive research to demonstrate the complete safety of a virus "insecticide" and to comply with Food and Drug Administration requirements for adequate demonstration of such safety.

CHEMICALS

(Publications on page 37)

Nitrogen Fertilizer Affects *Poria weirii*

Although fertilizing northwestern forests with nitrogen is currently being debated, one consideration has so far received scant attention: effects on root diseases. The widely occurring *Poria weirii*, cause of the laminated root rot of western conifers, merits special attention as a "disease of the site." That is, it can hold over in subterranean pockets of infectious material from one rotation to the next. When infection centers are cut and regenerated with such susceptible species as Douglas-fir, the disease can be expected to cause increasing damage over expanding areas. Heavily infected sites are not likely to produce merchantable stands of such species unless carryover infection can be radically reduced.

Fertilization of soil with nitrogen has proven to reduce survival of *Poria weirii* in buried wood cubes under laboratory conditions. Infected cubes were surrounded with soil in plastic containers in three treatments: (1) unfertilized soil, (2) soil mixed with NaNO_3 at a rate of 600 lb. N/acre ft., and (3) soil mixed with NH_4Cl at the same N rate. After the treatments were incubated at 15°C for 6 months, the cubes were extracted and assayed for living *Poria weirii*. The fungus survived

in about half the containers of untreated soil, but in only one of the 60 with fertilized soil.

The added nitrogen is not believed to affect *P. weirii* directly. Rather, it greatly increases activity of soil microorganisms that compete with, produce antibiotics against, or parasitize the pathogen. Studies are now being established to test effects of nitrogen fertilization on survival of *Poria weirii* under field conditions.

Foliage Sprays Fail on Salal

Amitrole-T, low volatile esters of 2,4,5-T, and mixtures of picloram with phenoxy herbicides did not kill salal when applied as foliage sprays during late July. These herbicides were tested on a dense, 2-foot-tall stand in the Coast Ranges of southwestern Oregon. The greatest effect on any plot consisted of a limited defoliation and slight top kill after 15 months — an unacceptable degree of control for site preparation or release of small coniferous trees.

Herbicide tests such as these are part of the Station's continuing search for safe, effective methods of vegetation management for intensive forest production.

Cooperative Forest Fertilization Research

The Experiment Station has joined with public and private organizations to support the "Regional Forest Nutrition Research Project" administered by the College of Natural Resources, University of Washington. The Project's goal is to develop guides for planning large-scale fertilizer applications to forest lands. With contributions from cooperators, the University will establish and report results from a balanced series of fertilizer trials (108) in western Oregon and Washington in 15- to 60-year-old forests of Douglas-fir (720 plots) and hemlock (288 plots).

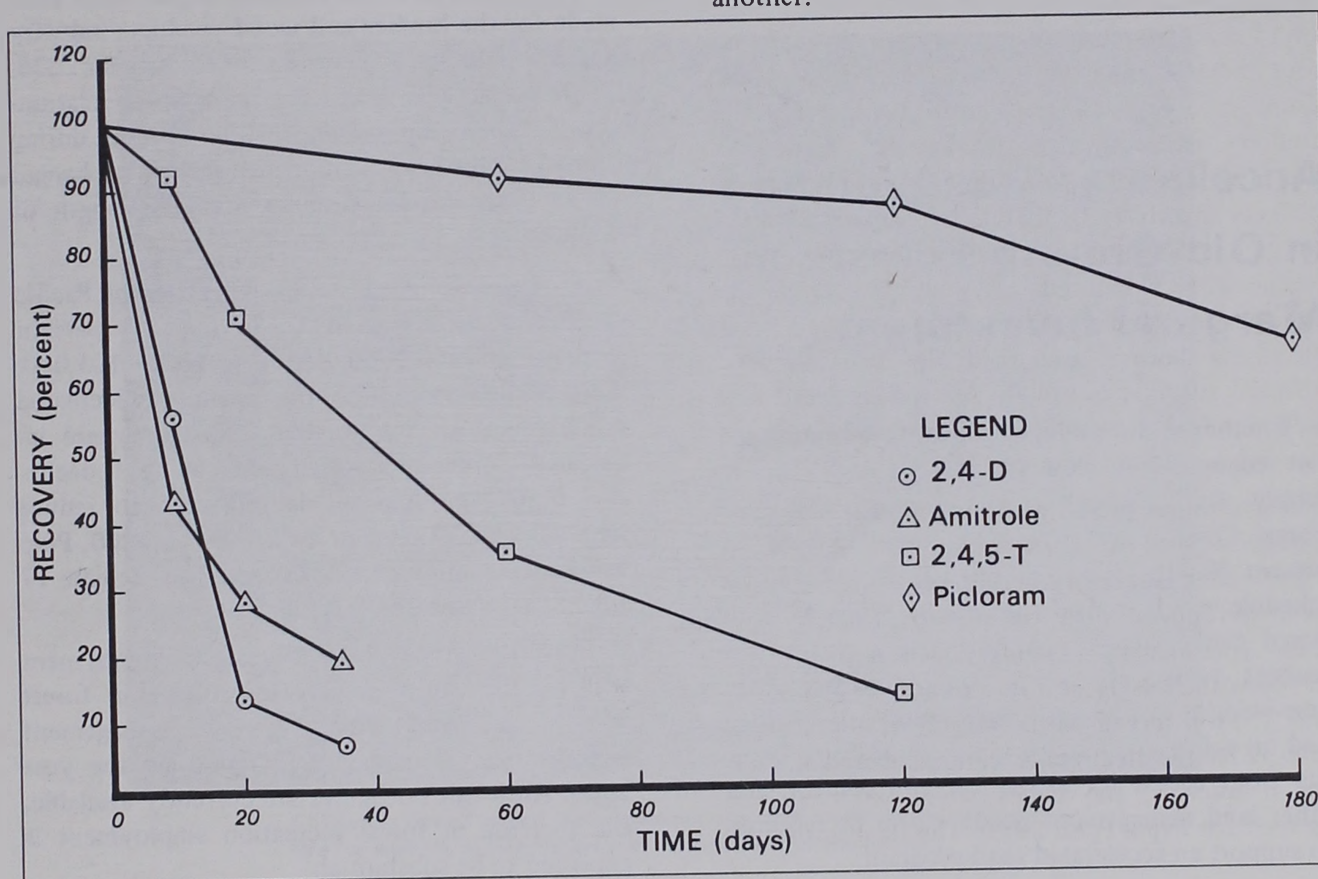
These trials are designed to predict growth response to a given application of nitrogen under specific stand and environmental conditions.

Herbicides in the Forest Floor

Relatively rapid degradation of four herbicides in the forest floor suggests they have little significant impact on the quality of the forest environment when properly used.

We measured the rates of degradation of four common brush control chemicals – 2,4-D, 2,4,5-T, amitrole, and picloram – in forest floor material from a red alder stand. The study was conducted in the laboratory, and conditions for herbicide degradation were favorable.

All four herbicides were degraded but at markedly different rates. Amitrole and 2,4-D were most rapidly degraded. At 35 days after treatment, 6 percent of the 2,4-D and 20 percent of the amitrole remained. In contrast, 13 percent of the 2,4,5-T remained after 120 days, and 65 percent of picloram after 180 days. The individual rates of degradation of these herbicides remained the same when they were applied in combination with one another.



ECONOMICS IN FOREST MANAGEMENT

(Publications on page 38)

Forestry Activities Affect Metropolitan Economies More Than Rural Areas

A disproportionate share of any increase in total regional employment resulting from stepped-up activity in timber industries would occur in Seattle, Tacoma, Portland, and Eugene. Because some forest products firms and much service activity supporting timber industries — lawyers, wholesalers, specialty shops — are in these cities, less than half of any new jobs coming from forestry programs would be generated in rural areas.

Accelerated Roadbuilding in Old-Growth Forests a Marginal Investment

Whether or not prelogging and mortality salvage can economically add to the Nation's timber supply was studied on the Umpqua National Forest. Costs of accelerating roadbuilding from the present 30-year plan to a 5- to 20-year completion schedule were arrayed against the value of additional timber gained. At interest rates above 4 percent (which is below the current Federal borrowing rate), advance roading cannot be justified on solely economic grounds. Additional benefits from access for recreation, fire control, and other land management needs would be required to support an accelerated road program.



A logging access road into a merchantable stand on the Willamette National Forest. (Forest Service photo 483388)

Forest-Based Employment To Decline in Pacific Northwest

Projections of forest industry employment were made for the lumber and wood products industry and the pulp and paper industry to the year 2020. These projections, based on trends in the relationship between employment and wood input during 1950-65, take into account such factors as changes in log size, worker productivity, and length of work week.

Total forest industry employment in the Pacific Northwest is expected to decline 28 percent during the 1965-2000 period to about 105,000. This decline would be the result of decreased employment in the lumber industry, where increasing worker productivity coupled with declining wood consumption is projected to reduce employment 39 percent to 73,000 in 2000. Pulp and paper employment is expected to increase 17 percent to about 32,000 employees.

Offsetting some of the decrease in employment will be the much greater investment in forest management. Employment in forest management is projected to increase by 16,000 by the year 2000. Although no figures are currently available, the increase in forest recreation employment is expected to be substantial.

FIRE

(Publications on page 38)

Alaska Wildfire Rate of Spread Rapid

Over 4 million acres of forest and range land burned in interior Alaska during 1969 to make one of the worst fire seasons on record. Smoke from the fires, some which were larger than 500,000 acres, reached as far south as Washington and Montana, and the widespread smoke pall over Alaska was so great that it was recorded by weather satellites. During the period, we made rate of spread measurements on several fires in cooperation with the Office of Civil Defense and the Bureau of Land Management. Rates of spread on the Swanson River fire exceeded 1 mile per hour. This study of free-burning, field-size fires provides a basis for testing predictive fire behavior models for use of fire fighters planning fire control strategies.

Fire Retardant and Slash Fires

A large-scale field study was carried out to investigate the effects of diammonium phosphate, a popular fire retardant, on the behavior and air pollution potential of slash fires. Cooperators included the University of Washington, seven units of the U.S. Forest Service (including three projects from the Riverside Forest Fire Laboratory), the University of California, the State of Oregon, and the Monsanto Company of Cincinnati, Ohio. Preliminary results indicate the retardant did not significantly change fire behavior, did not increase fuel reduction, increased smoke output, and resulted in alarmingly high levels of carbon monoxide and hydrocarbons.



Collecting rate-of-spread and supplementary data on the Swanson River fire for analysis of fire behavior in various parts of the country.

FISH, WILDLIFE, AND TIMBER

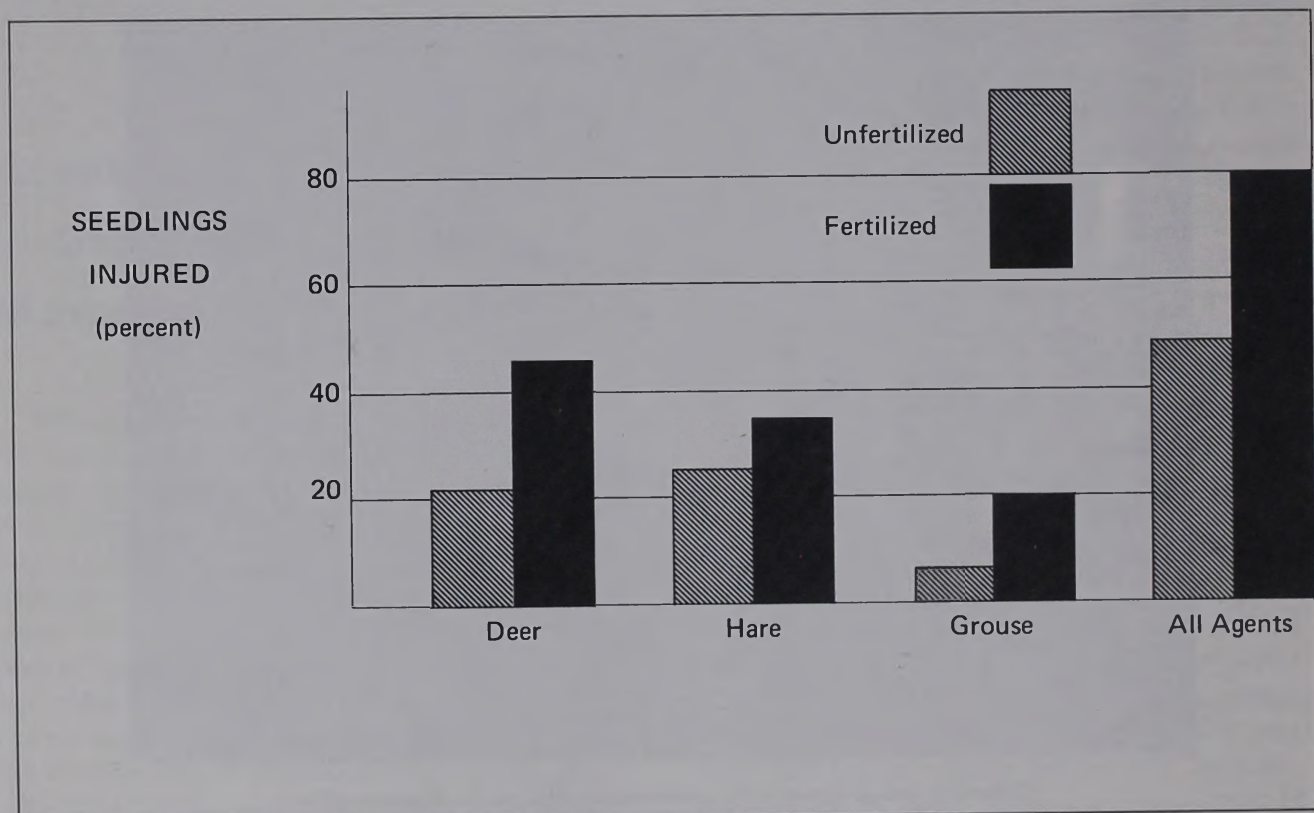
(Publications on page 39)

Essential Oils of Douglas-fir Affect Rumen Microbial Digestion of Deer

Our recent work with penned black-tailed deer has demonstrated conclusively, and for the first time, that different genotypes of Douglas-fir are not equally preferred by the animals. Using preferred and resistant Douglas-fir clones, chemical analyses and in vitro digestibility studies with deer rumen fluid now suggest that essential oils of these plants may be associated with preference through their effect on rumen microbial digestion. Verification of this finding with more clones of Douglas-fir and with other plant species could make it possible to screen seedlings for resistance to browsing without use of live deer and to use components of essential oils which inhibit digestion by deer as chemical protectants for preferred trees.

Urea Increases Wildlife Injury

Nitrogen fertilizer, applied as urea prills (46 percent N), sharply increased wildlife injury to Douglas-fir seedlings on seven out of seven study plantations in western Washington. One year after treatment, incidence of injury averaged 67 percent higher on seedlings treated with 200 lbs. N/acre than on those left untreated. Browsing, chiefly by black-tailed deer, occurred on all seven plantations; clipping, chiefly by snowshoe hare, occurred on six; and budding by blue grouse took place on three. Moreover, the increase in seedling injury due to fertilizer was similar for all wildlife agents — considered separately or collectively.



Timber and Salmon

Clearcutting in southeast Alaska need not damage salmon streams when logging is carefully done. The returns of pink and chum salmon during and after logging confirm this conclusion.

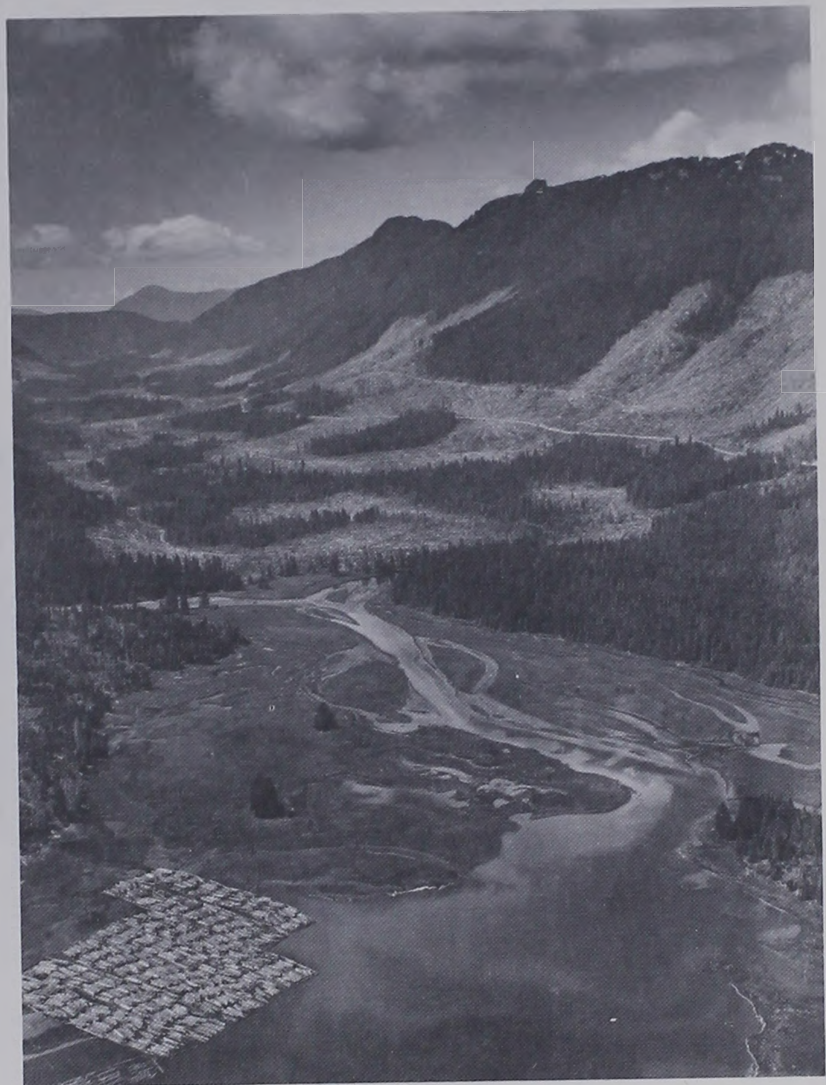
Much debris occurs in streams under natural conditions. Logging in one watershed slightly increased the amount of debris. Increase in another watershed was greater because high volume stands were harvested down to the streambanks. In neither case was significant harm to salmon environments detected.

In Alaskan clearcut watersheds, the suspended sediment concentrations increased during logging,

especially during road construction; but compared with stream sediment in an unlogged watershed, the increases were not significant. The concentrations only rarely and briefly exceeded 100 parts per million. Under natural conditions, suspended sediment concentrations are highly variable, generally paralleling streamflow variation.

Clearcutting increased stream temperature up to a maximum of 9°F. in the summer months, and the maximum average monthly increase was 4°F. Records for 14 years for one stream show that temperatures exceeded 68° for 6 consecutive hours. Temperatures greater than 65°F. lasted more than 8 hours only once during this period. Winter temperatures were little affected. These small changes probably reflect the generally cool and overcast weather of coastal Alaska.

An example of clearcutting in vicinity of a salmon stream. Harris River watershed, Prince of Wales Island, Alaska, 1961.



GENETICS

(Publications on page 40)

An Advanced Seed Orchard

A small seed orchard is being established near Corvallis that is essentially a generation ahead of other orchards in the Douglas-fir region. Material for the orchard was selected from 120 open-pollinated families which have been field tested in the Douglas-fir Heredity Study, now 57 years old. Scions from the best trees of the best 20 families will be grafted into the orchard. Selections within these families are being made at plantations located at 2,600 and 4,600 feet on the same slope near Mount Hood. The seed orchard is being set up for future breeding among progeny of the 20 parents and to produce seed for medium to high elevations in the Cascades.

Easier Spotting of Incompatible Grafts

Grafting incompatibility was, until recently, the primary problem of Douglas-fir seed orchards.

A new method in the recognition of incompatibles promises substantial reduction in the amount of work. Ordinarily, each graft is cut into thin sections for anatomical examination. This year, it was observed that the incompatible grafts generally burst bud later, possibly due to restriction through the constricted phloem. Parent-by-parent examination showed that about half of the incompatible grafts could be eliminated without error by inspection. Thus, it now appears possible to appreciably reduce the number of grafts that need to be laboriously sectioned by referring to carefully kept bud bursting records.



Seven stages of Douglas-fir vegetative bud development. On left is unexpanded bud; on right is burst bud.

INSECTS

(Publications on page 40)

Spruce Beetle Flight

Adult flight is an initial step in the spread and tree attack pattern of bark beetles. Flight traps were installed during 1969 in two locations in Alaska to determine the period of adult dispersal of the spruce beetle, *Dendroctonus obesus*. The areas represent different climatic patterns; Bonanza Creek is typical interior Alaska, and the Kenai Peninsula is influenced by the ocean.

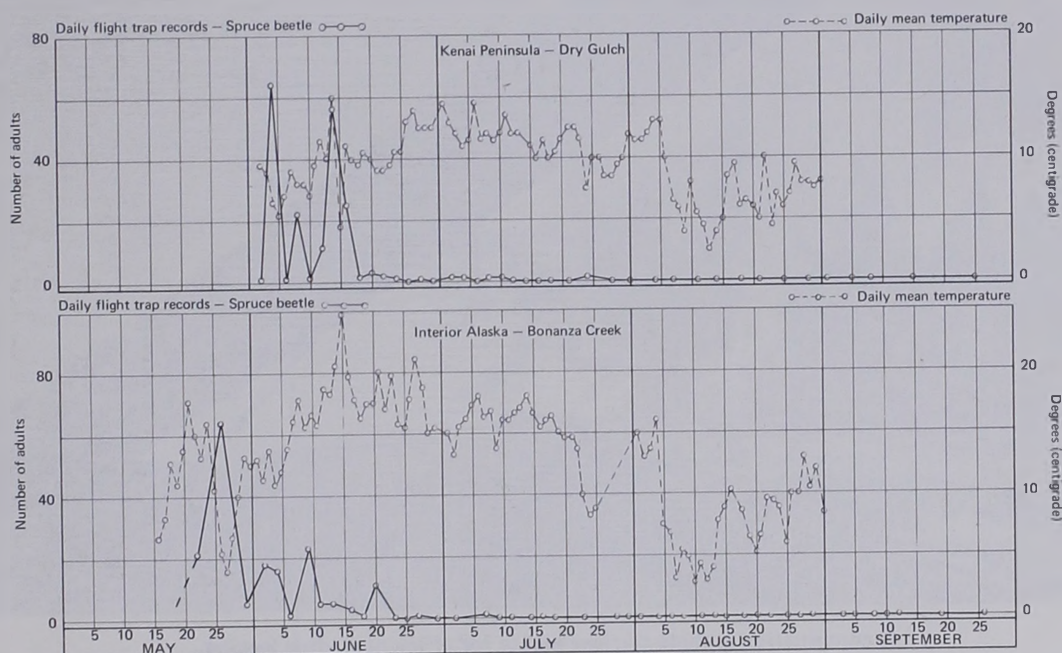
In both locations, the major adult flight occurred soon after snow disappeared from the woods. The Bonanza Creek flight was about 2 weeks prior to the flight that occurred on the Kenai Peninsula. The duration of major adult emergence was 3-4 weeks. In interior Alaska, snow disappeared early in May; snow was still on the ground until late May at Dry Gulch on the Kenai Peninsula. The interior mean daily temperatures are generally warmer than those of the coastal areas during the spring and early part of the summer.

Sanitation cutting or the use of "trap" trees is often used as a control measure for the spruce

beetle. Success will be greatly reduced unless the trees are treated or removed by the time adult flight begins. So the best timing for treatment should be in the fall or before or immediately after snow has disappeared in the spring.

Resistance to Needleminers

Populations of the lodgepole needleminer (*Coleotechnites* spp.), a serious defoliator of lodgepole pine in central Oregon, are several times higher in pure stands of mature lodgepole than in young stands with a mixture of ponderosa pine. Recent tests in the field and laboratory have demonstrated that the tops of trees and deep-rooted trees growing in drainages have foliage that is especially resistant to attack. Further, a volatile leaf oil, which could be a deterrent to feeding by young needleminer larvae, was often found in these trees. By developing cultural practices which produce resistant foliage, we may be able to prevent destructive outbreaks of the needleminer.



LOGGING

(Publications on page 41)

New Skyline Logging Technology

Grapple yarding with running skylines is a significant advance in logging technology. Crew size and labor costs are reduced, as are soil disturbance and road and loading costs. The system permits economical yarding at night and in deep snow.

Research engineers have developed computer

techniques for running skyline design, guides for planning efficient skyline operations, and procedures for anchoring skylines. Results were presented at a skyline logging symposium sponsored by Oregon State University and the Station in January 1969. The symposium proceedings are available from OSU's School of Forestry.



A combination grapple-carriage makes for efficient skyline logging.

MENSURATION

(Publications on page 41)

A New Measure of Douglas-fir Potential

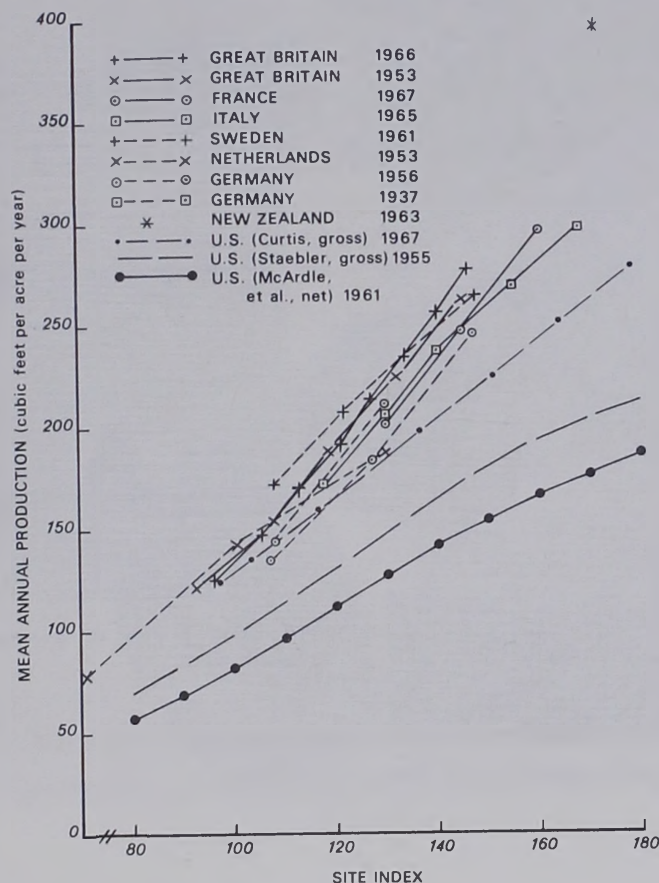
Nine foreign production tables for Douglas-fir plantations were converted to American units of measure. These thinning guides suggest that potential yields of intensively cultured Douglas-fir in the Pacific Northwest may be higher than has been estimated on the basis of yield tables for natural unthinned stands. They indicate higher yields when regular thinnings start in stands 30 to 40 feet tall than if delayed until stands are 50 to 60 feet tall. The tables suggest that culmination of mean annual production with heavy thinning may occur at 65 to 85 years. These foreign tables are now available as guides to potential yields under management practices equal in intensity to those applied in foreign plantations.

Extensive tests are now needed to determine the best management intensities to apply under conditions in the Northwest.

Easier and More Economical Sampling of Tree Growth

Station scientists are constantly searching for cheaper and more efficient ways of collecting technical data. Handling costs were reduced in radial growth studies by transporting from the field to the laboratory only representative radial sections instead of complete stem cross sections of felled trees. For permanent record of radial development, decadal-growth was transcribed to heavy, clear plastic. Use of transparent plastic in the field permitted recording radial growth where rot or shake precluded collection of radial sections.

A newly developed ratchet-handled increment borer has proven to be both quick and efficient when cores instead of radial sections are taken to sample tree growth.



PATHOLOGY

(Publications on page 41)

New Needle Disease Damages Pine Plantations

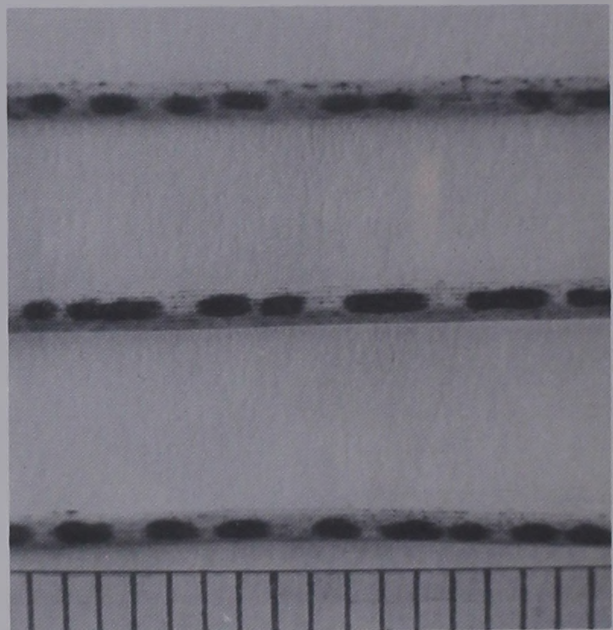
A new needle disease is causing extensive damage in western Oregon ponderosa pine plantations established on sites difficult to regenerate with other species. The disease, epidemic in 19 plantations, is caused by a previously undescribed fungus.

Needles of the current year become infected in June and July. By late summer, these needles turn reddish-brown giving the appearance of severe drought injury or windburn. Elongate,

dark-colored fruiting bodies, appearing in late fall on the infected needles, mature and discharge spores the following year during periods of high rainfall. Infection of new needles occurs immediately. The old needles are cast in midsummer giving infected trees a decided tufted appearance. Vigor and growth of affected trees are reduced and mortality results from repeated defoliation. The disease appears to be most damaging in off-site ponderosa pine plantations. It has not been found in natural stands.



Crown damage to ponderosa pine caused by a new needle disease.



Fruiting bodies of a new disease of ponderosa pine plantations.

Trees and Truffles

Pacific Northwestern forests, long regarded a paradise for fungi above ground, are now known to also produce an astonishing array of subterranean-fruited fungi. Such fungi, termed "hypogeous" (under-the-earth), occur in a variety of colors and sizes and generally resemble small potatoes in form. All are believed to form mycorrhizae with trees or other vascular plants. Mycorrhizal fungi are vital for nutrient absorption of the host plants and protect rootlets from disease attack.

Current exploration by Station mycologists is revealing many new species of hypogeous fungi and advancing the limited knowledge of their

occurrence. Of the various groups under study, truffles are the best known due to the several prized edible species of Mediterranean countries. No such gastronomic delights have been discovered in the Pacific Northwest, but the region does contain nearly half the world's known species. Some 30 have been found nowhere else. Other groups also abound. Over half of the 300-odd hypogeous puffballs occur here, as do nearly all the species of *Endogone*, which form the endomycorrhizae characteristic of the Cupressaceae, many hardwoods, and most herbaceous plants.

Continuing field exploration and studies on classification and physiology are laying groundwork for ultimate manipulation of species especially effective in biological control of root diseases.



Hypogeous fungi in natural size, showing outer surface and cut interior surface: (above) a truffle, *Tuber californicum*, (below) a puffball, *Rhizopogon subradicatus*.



***Poria* Root Rot Damage Evaluated**

Results from 20 years of field research on *Poria weirii*, a destructive root rot fungus of many conifers, will soon be available in a Station publication. At present, direct control of the disease is impossible and forestry must be practiced "by the acre." Recommendations to forest managers whereby the impact of this disease may be reduced in the Douglas-fir type include:

1. Become familiar with the disease — some infection is present in most stands.
2. Where infection is abundant, do not waste money on precommercial thinning — yields

will be reduced but thinning will result in windthrow of trees which otherwise might survive to merchantability.

3. In heavily infected merchantable stands, either clearcut or take only dead and dying trees — infected trees are not windfirm and windthrow often follows partial cuts.
4. Give priority to logging areas where the disease is most abundant — little or no net growth occurs in such areas and many dead trees can be salvaged.
5. Confine plantings to uninfected portions of logged areas; do not plant where infection was abundant — brush may encroach on the site, but severe damage to the new stand is almost certain.



Poria root rot damage in an 80-year-old Douglas-fir stand.

PLANT ECOLOGY

(Publications on page 42)

Vegetation of Oregon and Washington

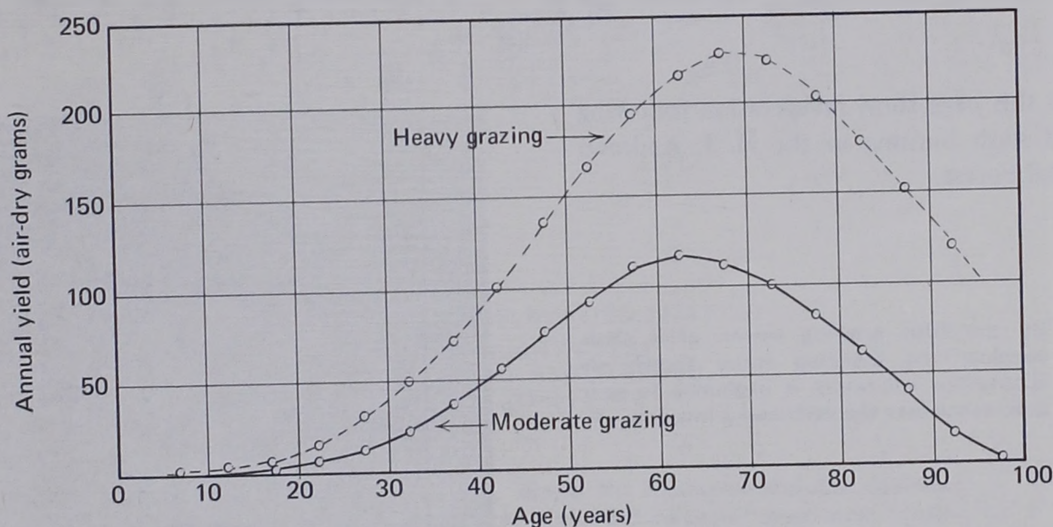
The vegetation of the Pacific Northwest is among the most diverse in North America, ranging from dense coastal forests of conifers through woodland and savanna to the sagebrush and grass associations of the dry interior. The ecology and plant geography of the region have been studied by scientists for over half a century, but much of the knowledge has been scattered through journals, books, theses, and unpublished data files. Two of our scientists have condensed this information in a generalized account of the major vegetation types of Washington and Oregon.

This publication (1) outlines the major phytogeographical units and suggests how they fit together and relate to environmental factors, (2) directs the reader to sources of more detailed information on vegetation and environment of the two States, and (3) illustrates the major plant communities with photographs. Research Paper PNW-80, "Vegetation of Oregon and Washington," will assist those new to the area in better understanding the complex mosaic of vegetation found here and provide some new insights for land managers and scientists already familiar with the region.

Heavy Grazing Reduces Bitterbrush Yields Per Acre

Bitterbrush (*Purshia tridentata*), because of its wide distribution and high palatability, is one of the most important shrub species in the West. How does yield vary with age in this plant, and how is the relationship between yield and age influenced by grazing? To answer these questions, we studied heavily and moderately grazed stands of bitterbrush.

Plants reached their maximum production in the 60-to-70-year age class under both intensities of use. When individual plants of the same age were compared, the heavily grazed plant always produced more usable forage than the moderately grazed one. However, although heavy grazing stimulates production, it apparently shortens life span. The moderately grazed stand had a much larger proportion of its total population in the age classes that produce the most forage than did the heavily grazed stand. As a result, moderate grazing produced twice as much forage per acre as the heavy grazing.



Relationship between average annual yield per plant and age of bitterbrush under heavy and moderate grazing.

Revegetation Following Logging and Slash Burning

In western Oregon and Washington, timber harvesting procedures often consist of clearcut logging followed by broadcast burning of logging slash. These activities result in drastic reduction in amounts of vegetation. Since plant cover curtails erosion and stream sedimentation, the length of time necessary for reestablishment of vegetation is of vital concern to land managers. To better understand revegetation trends, plant cover and composition were observed for 7 years on permanent plots in three logged clearcuts in the H. J. Andrews Experimental Forest. Observations were made the year prior to cutting the old-growth Douglas-fir-western hemlock stand and during each of five growing seasons following logging and broadcast slash burning.

Total plant cover was 15 percent the first year after slash burning, greatly increased to 49 percent the second, and showed consistent, more modest increases the next 3 years. By the fifth growing season after slash burning, plant cover totaled almost 80 percent — 6 percent contributed by trees, 17 percent by tall shrubs, and 57 percent by low shrubs and herbs. Vascular plant species totaled 48 before logging and increased to 72 species 6 years after logging.

Pictures on this page show revegetation following logging and slash burning in the H. J. Andrews Experimental Forest.

By the fifth growing season after slash burning, the invading shrub snowbrush (*Ceanothus velutinus*) is beginning to gain dominance over the herbaceous invaders. →



Virtually bare condition during the first growing season after slash burning.



During the third year, fireweed (*Epilobium angustifolium*) replaces groundsel.



RECREATION

(Publications on page 43)

Planning of Scenic Resources

Working with our Cooperative Recreation Research Project, two graduate students at the University of Washington have developed aids to the planning and protection of scenic resources.

With computer programs, the location of roads, shapes for timber harvest areas, and other modifications of the landscape can be tested and adjusted before commitments are made on the ground. Michimasa Kojima has developed computer programs that draw perspective views of the landscape

as it would appear from any selected point. One of these programs even includes vegetation symbols, drawn to scale, permitting a land manager to examine the visual effects of proposed changes.

The other student, Dale Potter, tested four methods of inventorying "visual impacts" on the landscape. In two of these methods, impacts visible from the highway were recorded by on-the-ground procedures. A computer was used to summarize the road mileages from which each impact type could be seen. The other two methods inventoried the impacts visible on aerial photographs but still related them to corridors along highways. Both scenic problems and opportunities can be identified by these methods.



FROM H [3 , 9] ELEVATION 1228 FEET
VIEWING HEIGHT 6 FEET
HORIZONTAL ANGLE 45 DEG.
DIRECTION TO H [6 , 16]

Perspective view of a landscape, drawn by computer, showing conifers (pointed symbols), broadleaved trees (rounded symbols), grass areas (small tufts), and logged areas (diagonal lines).

Effectiveness of Facilities at Visitor Centers

Visitor response to subject matter and interpretive facilities is being examined at four visitor centers.

Preliminary findings suggest that animals are of more interest to visitors than are plants and that information provided by a recorded voice is more likely to be retained than information provided on printed labels. In general, visitors remember concrete facts better than abstract principles. Also, different age groups may respond differently to interpretive facilities. Children enjoy something they can touch or manipulate, and adults often avoid such exhibits, especially tests that might show them to be wrong.

Characteristics of Conservation Groups

The conservation-preservation movement is becoming a major politico-economic development of the 20th century United States, where two distinct philosophies are in conflict. Conservation-preservation finds its strength in a growing number of conservationist organizations and outdoor clubs, while a conservation-utilization perspective is strongly supported by resource management professions and commodity interests. Recent success of conservation-preservationists indicates their growing political strength, although those belonging to organized groups make up only 1 to 2 percent of the population. Generally, members of the conservation groups can be categorized as upper-middle class. They are often highly educated, upper-income professionals whose activities are socially oriented.

Study of an Oregon-based outdoor club indicated that those members most strongly interested in conservation, reflected by their membership in other outdoor clubs, specialize in the type of organization they join. These conservationists concentrate their extracurricular memberships in conservation-related groups and are more actively involved than other members (who tend to spread

their memberships across a wider range of interests in which they are less active). This specialization may reinforce extreme ideological perspectives and organizational commitment to a difficult cause.



Ohanapecosh Campground, Mount Rainier National Park. (National Park Service photo.)

Social Aspects of Outdoor Recreation

Traditionally, camping has been viewed as a means of escape from the soiled environment and social complexities of urban life to the isolation and beauty of nature. But many small and primitive campgrounds have become large and intensively developed with closely spaced campsites, water systems, flush toilets, showers, paved roads, and special equipment for trailers. In these highly developed areas, motives for camping are varied and increasingly nontraditional as many of the campers seek social experiences.

Many benefits result from the developed campground. Campers easily and informally meet and visit with other people. Valuable social contact occurs across a broad set of age groups and between members of different social levels. Enhancing the social aspects of camping may be as important to enriching the camping experience in developed settings as is enhancing the environmental aspects elsewhere.

REGENERATION

(Publications on page 43)

Frost Damages White Spruce Cones

Until 1969, no quantitative observations were available concerning the effect of climatic conditions on white spruce seed production in interior Alaska. Warmer than average temperatures in April and May followed by a late frost on May 27 caused up to 100-percent conelet mortality in some stands, but in others there was no apparent

damage. Seedfall observations indicated, however, that there may have been a reduction in seed quality in some otherwise seemingly undamaged cones. In addition to the significant variation in conelet mortality between white spruce stands, there was also significant variation in damage between trees in the same stand, between cones on the same tree, and between scales on the same cone. This type of damage may be uncommon, but it, along with other factors that reduce seed production, can prolong the natural reestablishment of white spruce stands.



Variation in cone damage in white spruce cones in interior Alaska caused by frost in 1969. (Top row, far left — dead cone; bottom row, far right — apparently undamaged cone; other cones have variable number of damaged scales).

SOILS, SITE, AND GEOLOGY

(Publications on page 44)

Indicator Plants for Management Decisions

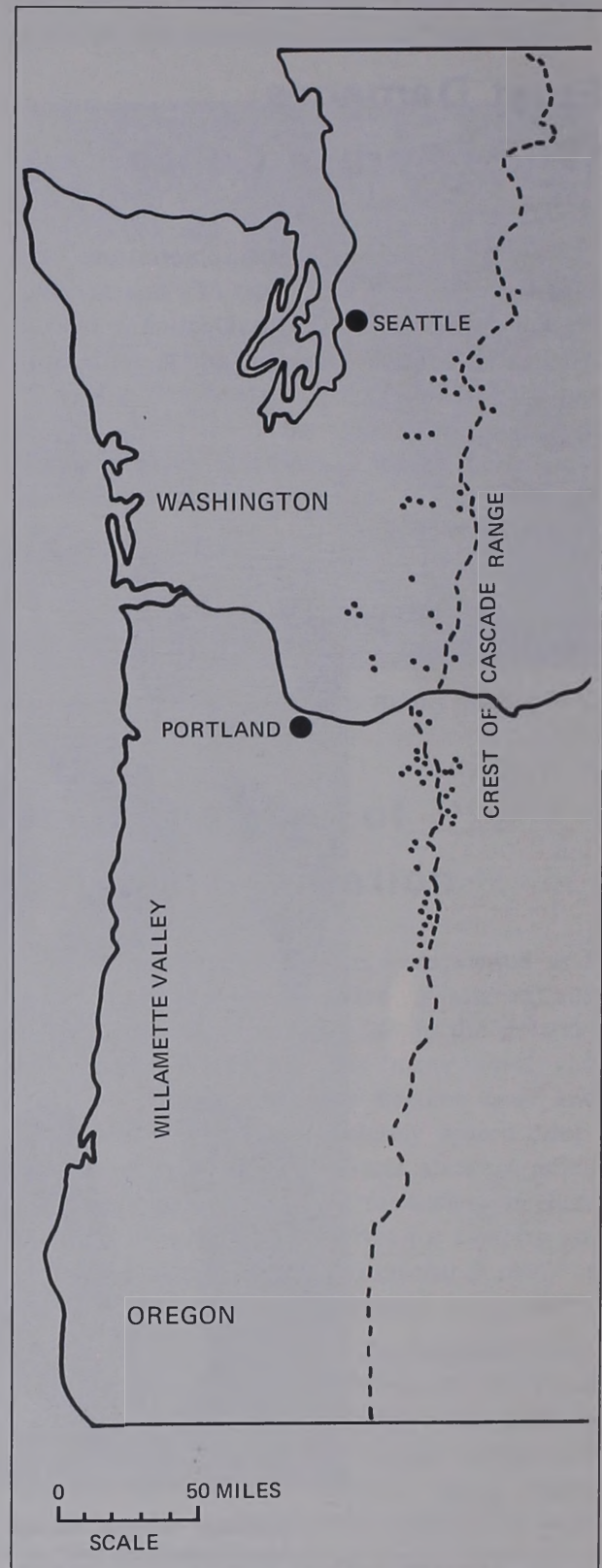
Understory vegetation in ponderosa pine and mixed conifer forests may be useful as an indicator of soil-site potential and in selecting management alternatives for integrated resource use. Similarity analysis of vegetation on 55 forested sites shows that certain plants common to volcanic ash soils are absent or rarely found on residual basalt soils.

Elk sedge and pine grass, major forage species for elk and cattle, occurred most frequently on mixed soils with high ash content.

If further study shows the relationships to hold constant, plant frequency may be a useful indicator in integrating range and wildlife resource values with timber management practices.

Site Index Curves for Noble Fir

Analyses of stem sections from 70 old-growth noble firs in locations from McKenzie Pass, Oreg., to Stevens Pass, Wash., are being used to develop site index curves for this species. Preliminary curves show that height ranges from 50 to 150 feet at age 100. Sectioning of 210 trees of associated species in the same area is providing data for growth comparisons between species and for study of growth capacity of complex upper-slope stands.



Old-growth noble fir stem analysis plots.

SUPPLY AND DEMAND

(Publications on page 45)

Forest Productivity Overstated in Eastern Oregon

Analysis of several hundred Forest Survey field plots last summer in an eight-county area of eastern Oregon shows that conditions which limit productive capacity are widespread in this area. It has become apparent in recent years that the usual procedure of rating productivity overestimates the growth potential of natural stands because there are some acres that are not capable of supporting the levels of stocking assumed in normal yield tables. Such limiting conditions include nonforest land, such as rock outcrops, streambeds, shallow soils, and inadequate water.

Nearly 60 percent of the commercial forest plots in this area were found to have inhibiting factors which reduce productive capacity below that indicated by the normal yield table. About 10 percent of the plots that would have qualified as commercial forest land were reclassified as non-commercial because of factors that reduced their growth capacity to less than 20 cubic feet per acre per year. It is evident that in this area of eastern Oregon, use of conventional methods would result in a substantial overestimate of the potential productivity and of the commercial forest area.

New Timber Resource Data for Olympic Peninsula

A new report on the timber resources of the Olympic Peninsula shows that the area of commercial forest land available for timber growing has decreased about 3 percent since 1953. Con-

tinued decreases can be expected, particularly in the eastern portion of the Peninsula where population pressures are expected to shift an additional 200,000 acres to residential, commercial, and recreational use by the year 2000.

The total volume of sawtimber is estimated to be 82.6 billion board feet, about 1 percent less than in 1953; but the proportion as well as the absolute volume in hardwoods has more than doubled, and the average size of timber has decreased.

For the area as a whole, growth and cut are about in balance. However, the situation varies between owner groups. High growth and low cutting rates on private lands with large areas in young stands are counterbalanced by low growth and high cutting rates on the public lands with substantial areas in old slow-growing stands.

Need for Timber Most Important Determinant of Stumpage Prices

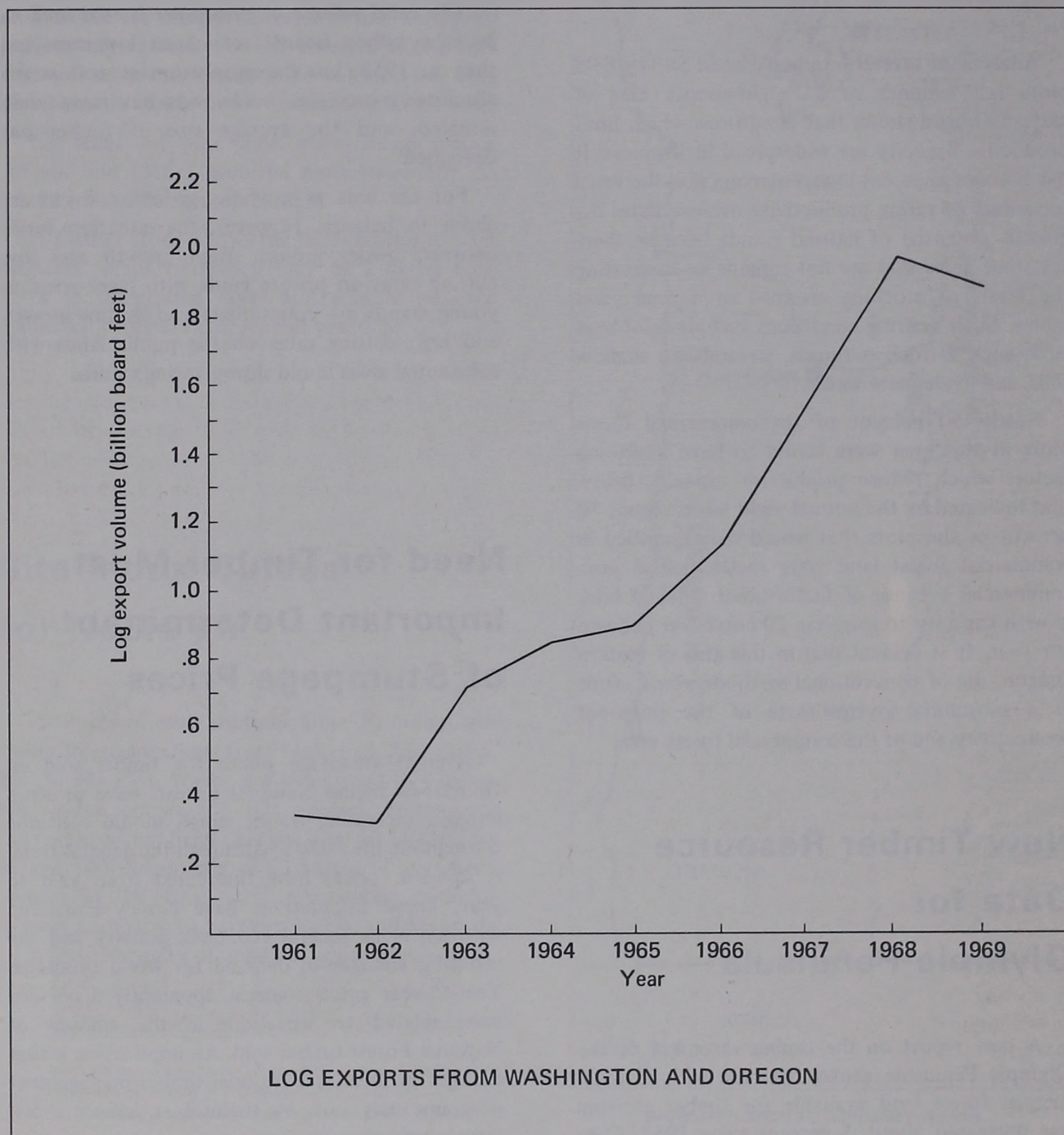
Average stumpage prices for timber sold on Douglas-fir region National Forests have shown a longrun increasing trend, which should continue throughout the 1970's. Although the general trend is upward, prices have fluctuated from year to year. These fluctuations have closely coincided with shifts in general economic activity and the resulting changes in demand for wood products. Year-to-year price changes apparently have not been related to variations in the amount of National Forest timber sold. An implication is that changes in local and regional timber management programs may not, by themselves, induce short-term stumpage price changes.

Log Exports Decline in 1969

Log exports from Oregon and Washington declined for the first time since 1962; the 1969

export volume of 1,870.8 million board feet was down 5.2 percent from 1968. The average value of the 1969 shipments was \$117.44 per thousand board feet compared with \$102.37 in 1968.

In 1969, log exports from northern California totaled 206.7 million board feet and shipments from Alaska were 31.9 million, down 2.6 and 32.3 percent, respectively, from 1968.



TIMBER MANAGEMENT

(Publications on page 45)

Converting Red Alder Stands to Douglas-fir

This study shows where it is more profitable to replace red alder stands with Douglas-fir than to manage for red alder in the Pacific Northwest. Under most of the circumstances analyzed, alder stands should be immediately replaced. Red alder management is economically justified only when sites are poor, stumpage prices low, and costs high. In order of importance, the critical variables in this decision were found to be the discount rate, site productivity, expected stumpage prices, present age of the existing red alder stand, costs of conversion, and annual management costs. [Sensitivity analyses show how these variables may influence the conversion decision. See Yoho, Chappelle, and Schweitzer in Annotated List of Publications (Supply and Demand).]

High Yields from Thinned Lodgepole Pine

Stand density control can greatly increase yield of usable lodgepole pine wood. A 32-year-old stand at Twin Lakes near Bend, Oreg., thinned to 85 trees per acre now has an average diameter of 8.9 inches with 45 trees in the 9-inch- (minimum bd.-ft. size) and-larger class and a reasonable expectation that all will reach 9 inches in the next 10 years. These trees have grown 1.1 inches in diameter in the last 5 years and added an average of 61 cubic feet per acre annually. Both a gross yield table and data from some much older thinning plots at nearby Pringle Falls indicate that increases in stand density with the passage of time will more than offset the expected decline with increasing age, at least through age 90. Expected production to age 90 would equal 4,318 cubic feet or 21,590 board feet, approximately two-and-one-half times average production of unthinned stands.

A New Levels-of-Growing-Stock Installation

The Forest Service has established a third thinning study area as part of the Cooperative Level-of-Growing-Stock Study in Douglas-fir. Results from this new installation on Site IV land on the Umpqua National Forest in southwestern Oregon will be compared with those from other installations on Sites I-III and particularly with another Site IV study area on the Olympic National Forest in northwestern Washington where growing conditions are quite different.

The Levels-of-Growing-Stock Study is a long-term cooperative effort among private industry and educational and governmental agencies for identifying optimum thinning treatments to achieve certain management objectives. At each of the seven installations thus far established, eight thinning regimes and a control are replicated three times. Response of the 20- to 40-foot-tall stands has generally been good following an initial removal of about 60 percent of the stand basal area.



A full-crowned lodgepole pine tree on an 85-tree-per-acre plot. It has grown 1.4 inches in diameter and 6.4 feet in height during the last 5 years.

WATER

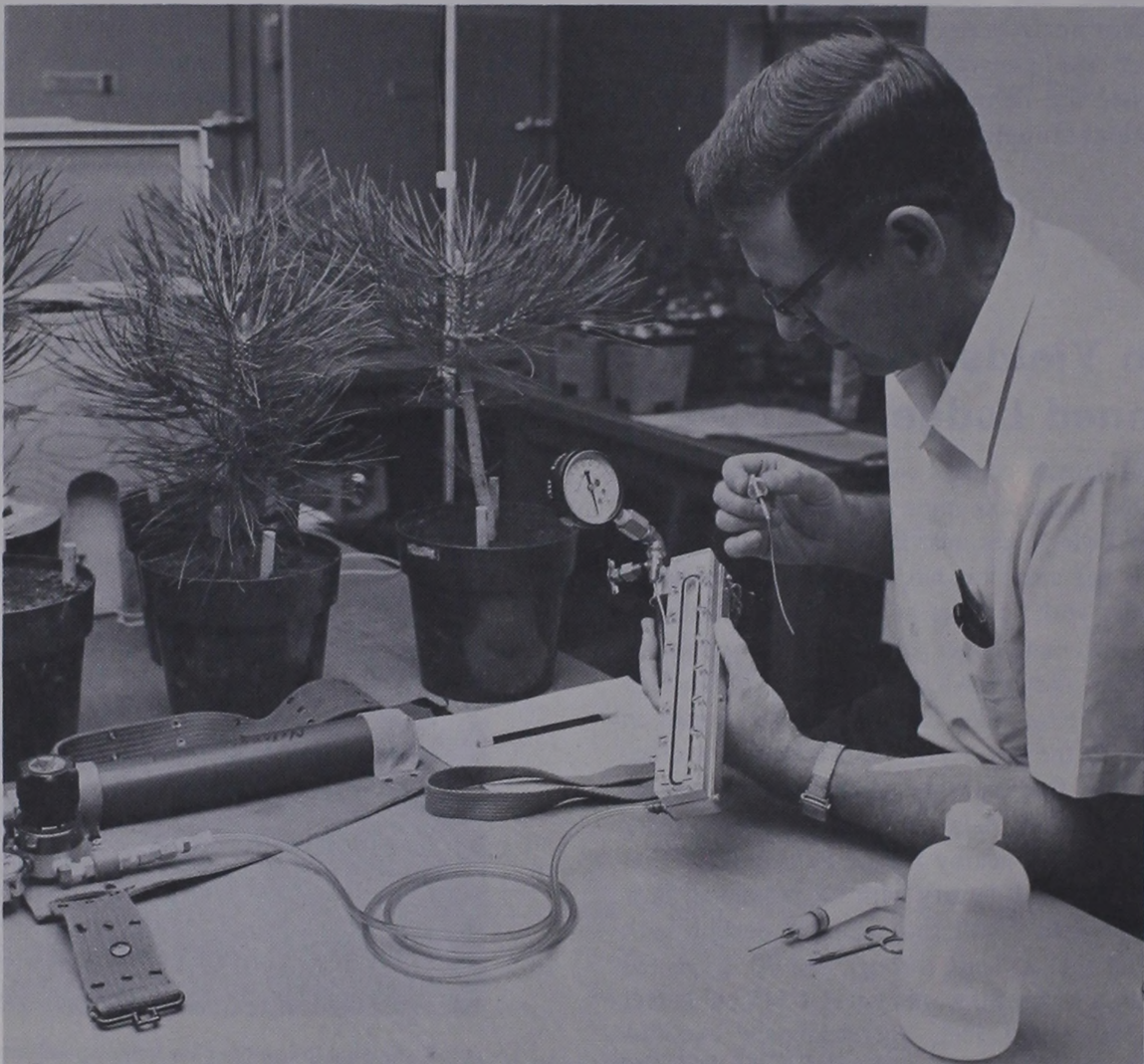
(Publications on page 45)

Stomatal Behavior in Conifers

Most water loss by trees is controlled by stomata — minute pores in leaf surfaces. The rate of loss depends on the degree of openness of these pores. Primarily because of the difficulty of measuring aperture in conifer needles, little information has been available on the behavior of stomata in conifers. A pressure infiltration technique which quickly assesses degree of stomatal opening was recently developed for laboratory and field use.

Sensitivity of stomata to leaf water stress for five species of conifers was determined by measuring transpiration rate, leaf water stress, and relative stomatal aperture of seedlings subjected to gradually increasing drought. The stomata of ponderosa pine, lodgepole pine, and Engelmann spruce closed at a lower leaf moisture stress than the stomata of Douglas-fir and grand fir, indicating a higher sensitivity to water stress in the pines and spruce.

This information will aid in watershed management by ultimately providing a basis for selecting water-efficient species.



WOOD UTILIZATION

(Publications on page 46)

Bark Useful in Agriculture

Agricultural use of the millions of tons of tree bark produced annually by the Pacific Northwest wood products industry would alleviate disposal problems and air pollution resulting from burning. Bark of the major tree species in this area can be used as mulch, soil conditioners, plant container mixes, drainage, and bedding in animal stalls, poultry houses, and stockyards. Any nitrogen deficiency caused by bark use on soil can easily be remedied by fertilization.

Barks of Douglas-fir and other commercially important species in this region contain 5 to 22 percent tannin by weight. However, normal agricultural applications of 10 to 100 tons of bark per acre appear harmless from standpoint of adding tannin to the soil. Purified Douglas-fir tannin and its effect on the soil microflora were studied in the laboratory. The soil microflora was generally increased; about 22 percent of the tannin decomposed in 180 days, and nitrate production was only slightly decreased.

The ameliorating effects of leaving bark on the forest floor after timber harvest should be considered in management of forest soils and watersheds. Bark, transported to the mill where it becomes a disposal problem, might better be removed at the logging site by portable machinery and left to provide a protective organic cover on the soil surface, incorporate an appreciable amount of organic matter with the soil, and return plant nutrients otherwise lost. The tendency of bark to retard nitrification and the assimilation of nitrate by microbes decomposing the bark might also reduce nitrate content of streams flowing from cutover sites.

Cost of Quiet in Apartment Buildings

Wood frame construction is lightweight and offers cost savings but also presents builders and designers with problems. One of these is insulation against airborne noise. Fortunately, as builders have a variety of materials to incorporate in lightweight walls or floor-ceiling constructions, the problem is only to decide what combination of materials will give the desired sound insulation at least cost.

Our field measurements of wall and floor systems in more than 20 apartment buildings show that builders are now providing wood frame partitions that range from sound transmission class 46 to 60. (STC is a single figure rating of general insulating properties of a partition.) Partitions having the lower values within this range are frequently considered just adequate; those having the higher values provide outstanding insulation.

A wall or floor with an STC of 56 is about twice as effective in reducing transmitted sound as is a wall with an STC of 46. The current in-place costs per square foot of wood frame walls vary from about \$1.00 for a wall with STC 46 to \$1.50 for a wall with an STC of 56, and for wood frame floors, from about \$1.30 to \$1.65 (not including the cost of finish floor, tile, or carpet).



Expansion of the Pulp and Paper Industry

Whether the Pacific Northwest can double its pulp and paper production capacity by 1985 to meet national paper needs depends on ability of the industry to control air pollution, solve water quality problems, and obtain an adequate wood supply.

Dr. J. Alfred Hall, consultant to the Station, predicts expanded use of the kraft pulping process and progress in improving water quality. Although kraft mills cannot be made odorless, substantial gains are being made in recovery of sulfur dioxide. Through aggressive utilization of logging residues, thinnings, and presently underused species, the 1985 wood needs of this key industry can be met.

A Tree Grading System for Inland Douglas-fir

A new timber grading technique was developed for predicting the value of individual tracts of timber. The method, a new concept in timber grading, is based on a lumber value predicting equation. Tested and used successfully in commercial timber sales, this approach is much easier

and less costly to use in timber cruising and computing the lumber selling value of tracts of timber.

The system uses five variables to estimate the lumber volume from each tree and its value — tree diameter, tree height, size of the largest limb in the butt log, percent defect, and length of the basal scar if one is present.

Estimating Veneer Losses in Plywood Production

In manufacturing plywood, it is necessary to estimate how much veneer will be lost in the several processing operations between the veneer dryer and the finished plywood panel.

Through studies at three typical plywood plants, factors were developed for estimating veneer losses during the jointing for edge gluing, reclipping, glue spreading, panel layup, and panel trimming operations. These loss factors are useful in making timber sale appraisals and for production control in plywood plants.

There is an average veneer loss of 16 percent in producing a finished plywood panel, with losses varying from 12 to 23 percent depending on the grade of the veneer and where it is used in the panel.

ANNOTATED LIST OF PUBLICATIONS

1969

THIS IS A LIST OF ALL PUBLICATIONS BY STATION STAFF AND COOPERATORS DURING THE YEAR 1969, INCLUDING PUBLISHED TALKS AND ADDRESSES (FEDERAL, STATE, OR PRIVATE COOPERATORS ARE INDICATED BY AN ASTERISK). AVAILABLE PUBLICATIONS MAY BE ORDERED BY THE FIVE-DIGIT NUMBER AT THE END OF AUTHOR LINE FROM PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION, P.O. BOX 3141, PORTLAND, OREGON 97208.

BIOLOGICAL CONTROLS

*BOVING, P. A., MAKSYMUK, B., *WINTERFELD, R. G., 12 69152
AND ORCHARD, R. D.
EQUIPMENT NEEDS FOR AERIAL APPLICATION OF MICROBIAL INSECTICIDES.

AMER. SOC. AGR. ENG., PAP. NO. 69-616, 12 PP., ILLUS.
A REPORT ON THE DEVELOPMENT OF THREE SYSTEMS MOUNTED ON A HELICOPTER FOR HANDLING VIRUS SPRAYS, INCLUDING DATA ON CONSTRUCTION, DROPLET SIZE DATA AND FIELD TESTING OF THE EQUIPMENT. (NO COPIES AVAILABLE)

MAKSYMUK, BOHDAN. 01 69035
BOOK REVIEW OF 'PROCEEDINGS OF THE JOINT UNITED STATES-JAPAN SEMINAR ON MICROBIAL CONTROL OF INSECT PESTS' BY GORDON R. STAIRS AND KEIO AIZAWA.
J. INVERTEBRATE PATHOL. 13(1), P. 159. (NO COPIES AVAILABLE)

MAKSYMUK, BOHDAN. 07 69094
MICROBIAL INSECT CONTROL--AN INTERDISCIPLINARY APPROACH.
SOC. INVERTEBRATE PATHOL., PP. 24-25. (NO COPIES AVAILABLE)

MARTIGNONI, M. E., IWAI, P. J., HUGHES, K. M., AND 01 69034
ADDISON, R. B.
A CYTOPLASMIC POLYHEDROSIS OF 'HEMEROCAMPA PSEUDOTSUGATA.'
J. INVERTEBRATE PATHOL. 13(1), PP. 15-18, ILLUS.
HISTOCHEMICAL AND HISTOLOGICAL STUDIES OF MIDGUTS OF LARVAE OF THE DOUGLAS-FIR TUSSOCK MOTH, 'HEMEROCAMPA PSEUDOTSUGATA,' INFECTED WITH CYTOPLASMIC-POLYHEDROSIS VIRUS SHOWED THAT THE VIRAL INCLUSION BODIES FORMED IN APICOBASALLY ORIENTED ROWS IN GOBLET AND COLUMNAR CELLS OF THE EPITHELIUM.

MARTIGNONI, MAURO E., IWAI, PAUL J., AND 07 69100
*WICKERHAM, LYNFERD J.
A CANDIDIASIS IN LARVAE OF THE DOUGLAS-FIR TUSSOCK MOTH, 'HEMEROCAMPA PSEUDOTSUGATA.'
J. INVERTEBRATE PATHOL. 14, PP. 108-110, ILLUS.
A STRAIN OF THE YEAST 'CANDIDA ZYLANOIDES' WAS ISOLATED FROM A LARVA OF THE DOUGLAS-FIR TUSSOCK MOTH. THE STRAIN WAS CHARACTERIZED ON THE BASIS OF CELL AND COLONY MORPHOLOGY, OF CARBON ASSIMILATION REACTIONS, AND OF SUGAR FERMENTATION. PERORAL INOCULATION OF LARVAE WITH THE YEAST INHIBITED THE GROWTH OF THE INSECTS, AND AT HIGH DOSES, IT CAUSED MORTALITY. THE YEAST CELLS MULTIPLY IN THE HINDGUT OF THE LARVAE.

*RICARD, J. L., *WILSON, M. M., AND BOLLEN, W. B. 02 69103
BIOLOGICAL CONTROL OF DECAY IN DOUGLAS-FIR POLES.
FOREST PROD. J. 19(8), PP. 41-45, ILLUS. (NO COPIES AVAILABLE)

DOUGLAS-FIR POLES CONTAINING INCIPIENT DECAY IN HEARTWOOD WERE INOCULATED WITH A FUNGUS, 'SCYTALIDIUM' SP. 'FY' STRAIN, TO LEARN WHETHER THIS FUNGUS WOULD INHIBIT GROWTH OF 'PORIA CARBONICA,' A PREVALENT ROT. VIABLE 'P. CARBONICA' DISAPPEARED FROM THE WOOD AS IT WAS PENETRATED BY THE 'FY' STRAIN. RESULTS SHOW PROMISE

FOR EVENTUALLY DEVELOPING BIOLOGICAL CONTROL OF ROT IN SERVICE POLES.

SCHMIEGE, DONALD C. 12 68164
POSSIBILITIES FOR BIOLOGICAL CONTROL OF FOREST INSECTS IN ALASKA. (ABSTR.)
19TH ALASKAN SCI. CONF. 1968, 1 P. (NO COPIES AVAILABLE)

TORGENSEN, TOROLF R. 06 69123
HYMENOPTER PARASITES OF THE HEMLOCK SAWFLY, 'NEODIPRION TSUGAE' MIDDLETON, IN SOUTHEAST ALASKA, WITH A KEY TO LARVAL REMAINS.

J. ENTOMOL. SOC. BRIT. COLUMBIA 66, PP. 53-62, ILLUS.
A KEY IS SUPPLIED TO IDENTIFY PARASITES REARED FROM HEMLOCK SAWFLY COCOONS IN SCUTHEAST ALASKA. THE KEY IS BASED ON SIZE OF EXIT HOLE, AND CHARACTERS VISIBLE ON THE FINAL-INSTAR LARVAL SKIN. BRIEF BIOLOGICAL AND DESCRIPTIVE NOTES ARE GIVEN FOR EACH SPECIES APPEARING IN THE KEY.

TORGENSEN, T. R., AND *COPPEL, H. C. 01 69058
PARASITES OF 'RHYNCHIA BUOLIANA' AND THEIR OCCURRENCE AT DIFFERENT CROWN LEVELS OF RED PINE IN WISCONSIN.
ANN. ENTOMOL. SOC. AMER. 62(1), PP. 163-169. (NO COPIES AVAILABLE)

TORGENSEN, TOROLF R. 02 69018
TWO EULOPHID PARASITES ASSOCIATED WITH THE BLACK-HEADED BUDWORM IN ALASKA.
CAN. ENTOMOL. 101(2), P. 180.
REPORTS NEW HOST RECORD OF 'ELACHERTUS AENEONIGER' AND ITS HYPERPARASITE, 'TETRASTICHUS CCRULESCENS,' ON THE BLACK-HEADED BUDWORM.

CHEMICALS

GRATKOWSKI, H. 02 69048
SCREENING TESTS OF PICLORAM ON SALMONBERRY.
IN 'RES. PROGRESS REP.,' WEST. SOC. WEED SCI. 1969, PP. 20-21. (NO COPIES AVAILABLE)

KLOCK, G. D. 02 69022
USE OF A STARTER FERTILIZER FOR VEGETATION ESTABLISHMENT. (ABSTR.)
NORTHWEST SCI. 43(1), P. 38. (NO COPIES AVAILABLE)

MOORE, D. G., HOLCOMBE, E. E., AND *STRAND, R. F. 02 69027
PHORATE PERSISTENCE IN A FOREST SOIL. (ABSTR.)
NORTHWEST SCI. 43(1), P. 40. (NO COPIES AVAILABLE)

NORRIS, LOGAN A. 02 69036
DEGRADATION OF SEVERAL HERBICIDES IN RED ALDER FOREST FLOOR MATERIAL.
IN 'RES. PROGRESS REP.,' WEST. SOC. WEED SCI., PP. 21-22.
AMITROLE, 2,4-D, 2,4,5-T, AND PICLORAM ARE DEGRADED IN FOREST FLOOR MATERIAL BUT AT MARKEDLY DIFFERENT RATES. PICLORAM WAS MOST PERSISTENT, FOLLOWED IN ORDER BY 2,4,5-T, AMITROLE, AND 2,4-D.

NORRIS, LOGAN A. 02 69038
HERBICIDE RUNOFF FROM FOREST LANDS SPRAYED IN SUMMER.
IN 'RES. PROGRESS REP.,' WEST. SOC. WEED SCI., PP. 24-26.
PHENOXY AND PICLORAM HERBICIDES WERE APPLIED IN THE
SUMMER TO SMALL WATERSHEDS. HERBICIDE RESIDUES IN FALL
RUNOFF FROM THESE LANDS WERE GREATEST WHEN THE CHEMICALS
WERE APPLIED IN LATE SUMMER TO A HIGH PERCENTAGE OF THE
WATERSHED AND WHEN THE FIRST FALL STORMS WERE OF HIGH
INTENSITY.

NORRIS, LOGAN A. 02 69037
SOME CHEMICAL FACTORS INFLUENCING THE DEGRADATION OF HERBI-
CIDES IN FOREST FLOOR MATERIAL.
IN 'RES. PROGRESS REP.,' WEST. SOC. WEED SCI., PP. 22-24.
THE DEGRADATION OF 2,4-D, 2,4,5-T, AND PICLORAM IN
FOREST FLOOR MATERIAL WAS NOT INFLUENCED BY PRETREAT-
MENT WITH CERTAIN OTHER PESTICIDES. THE RELATIVE RATES
OF DEGRADATION OF THESE HERBICIDES WERE NOT INFLUENCED
BY STARTING CONCENTRATION.

NORRIS, L. A., AND *MORRIS, R. O. 08 69113
QUALITATIVE CHANGES IN CYTOPLASMIC PROTEINS IN PLANTS
TREATED WITH GROWTH REGULATING CHEMICALS. (ABSTR.)
XI INT. BOT. CONGR., P. 160. (NO COPIES AVAILABLE)

NORRIS, LOGAN A., AND *MORRIS, ROY C. 02 69051
CHEMICALS IN PLANTS.
IN 'RES. PROGRESS REP.,' WEST. SOC. WEED SCI.
1969, PP. 103-104. (NO COPIES AVAILABLE)

TARRANT, R. F., MOORE, D. G., AND BILLEN, W. B. 07 69130
DDT RESIDUES IN FOREST FLOOR AND SOIL AFTER AERIAL SPRAYING.
AMER. SOC. AGRON. ABSTR. 1969, P. 126. (NO COPIES
AVAILABLE)
THREE YEARS AFTER AN OPERATIONAL AERIAL SPRAYING OF DDT
IN EASTERN OREGON, TOTAL DDT IN THE FOREST FLOOR HAD
DECLINED FROM A MAXIMUM OF 0.22 KG/HA TO 0.09 KG/HA. AT
THE SAME TIME, ONLY 0.001 KG/HA TOTAL DDT WAS PRESENT IN
THE 0-3 INCH SOIL LAYER AND NCNE WAS EVIDENT AT 3-6
INCHES. SOIL MICROBIAL POPULATIONS AND SOIL AMMONIFI-
CATION AND NITRIFICATION RATES WERE NOT AFFECTED BY DDT.

*TU, C. M., AND BILLEN, W. B. 09 69127
EFFECT OF TOROON HERBICIDES ON MICROBIAL ACTIVITIES
IN THREE WILLAMETTE VALLEY SOILS.
DOWN TO EARTH 25(2), PP. 15-17. (NO COPIES AVAILABLE)

ECONOMICS IN FOREST MANAGEMENT

CHAPPELLE, DANIEL E. 07 69095
A COMPUTER PROGRAM FOR EVALUATING FORESTRY OPPORTUNITIES
UNDER THREE INVESTMENT CRITERIA.
U.S.D.A. FOREST SERV. RES. PAP. PNW-78, 64 PP., ILLUS.
DESCRIBES A COMPUTER PROGRAM, WRITTEN IN FORTRAN IV,
FOR EVALUATING INVESTMENTS BY USE OF CRITERIA OF
PRESENT NET WORTH, BENEFIT-COST RATIO, OR INTERNAL
RATE OF RETURN.

SASSAMAN, ROBERT W., CHAPPELLE, DANIEL E., AND 02 69030
FRITCHMAN, KIRBY.
USER'S MANUAL FOR SORAC COMPUTER PROGRAM.
PACIFIC NORTHWEST FOREST AND RANGE EXP. STA., 80 PP.,
ILLUS.
DETAILED INFORMATION ON THE SORAC PROGRAM AND INSTRU-
CTIONS FOR ITS USE ARE LISTED ALONG WITH THE RESULTS AND
A DESCRIPTION OF A SAMPLE PROBLEM. THIS PUBLICATION IS
INTENDED ONLY FOR THOSE PERSONS WHO HAVE READ RESEARCH
NOTE PNW-93, WHICH ANNOUNCES THE AVAILABILITY OF THE
SORAC ALLOWABLE CUT COMPUTER PROGRAM, AND WHO DESIRE TO
USE THE PROGRAM AND/OR DESIRE MORE INFORMATION ON
SORAC.

SCHALLAU, CON, *MAKI, WILBUR, *BEUTER, JOHN. 06 69125
ECONOMIC IMPACT PROJECTIONS FOR ALTERNATIVE LEVELS OF
TIMBER PRODUCTION IN THE DOUGLAS-FIR REGION.
ANN. REG. SCI. VOL. 3(1), PP. 96-106, ILLUS.
FORECASTS SHOW THAT ALTHOUGH THE TIMBER INDUSTRY
STIMULATES ECONOMIC DEVELOPMENT OF THE DOUGLAS-FIR
REGION, GROWTH OF ITS ECONOMIC SUBAREAS CANNOT BE
ASSURED BY A SUSTAINED LEVEL OF CUT FROM ITS FORESTS.

USDA FOREST SERVICE. 06 69085
DOUGLAS-FIR SUPPLY STUDY.
53 PP. ILLUS. (COOPERATIVELY PREPARED BY REGION 5 AND 6
AND THE PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT
STATION.)
EXPLORES WAYS OF INCREASING TIMBER SUPPLIES FROM NATION-
AL FOREST LANDS IN THE DOUGLAS-FIR REGION OF WASHINGTON,
OREGON, AND NORTHERN CALIFORNIA. SUBSTANTIALLY LARGER
TIMBER HARVEST CAN BE SUPPORTED IMMEDIATELY AS WELL AS
IN THE FUTURE THROUGH INTENSIFIED TIMBER MANAGEMENT.
THE VALUE OF POTENTIAL INCREASES IN SUSTAINABLE HARVEST
GREATLY EXCEEDS THE HIGHER COSTS THAT WOULD BE INCURRED.

*YOHO, JAMES G., *CHAPPELLE, DANIEL E., 11 69146
AND SCHWEITZER, DENNIS L.

THE ECONOMICS OF CONVERTING RED ALDER TO DOUGLAS-FIR.
USDA FOREST SERV. RES. PAP. PNW-88, 31 PP., ILLUS.
THIS STUDY DEFINES THOSE CONDITIONS WHERE IT IS MORE
PROFITABLE TO REPLACE RED ALDER STANDS WITH DOUGLAS-FIR
THAN TO MANAGE FOR RED ALDER. UNDER MOST OF THE CIRCUM-
STANCES ANALYZED, RED ALDER STANDS SHOULD BE IMMEDIATELY
CONVERTED. IN ORDER OF IMPORTANCE, THE CRITICAL VARI-
ABLES IN THIS DECISION WERE FOUND TO BE THE DISCOUNT
RATE, SITE PRODUCTIVITY, EXPECTED STUMPAGE PRICES, THE
PRESENT AGE OF THE EXISTING RED ALDER STAND, COSTS OF
CONVERSION, AND ANNUAL MANAGEMENT COSTS. SENSITIVITY
ANALYSES SUGGEST HOW THESE VARIABLES INFLUENCE THE
CONVERSION DECISION.

FIRE

BARNEY, RICHARD J. 03 69102
INTERIOR ALASKA WILDFIRES 1956-1965.
USDA FOREST SERV. STA. MISC. PUB., 47 PP., ILLUS.
INTERIOR ALASKA FOREST FIRE STATISTICS HAVE BEEN SUMMA-
RIZED AND PRESENTED FOR THE PERIOD 1956-65. GRAPHIC,
TABULAR, AND NARRATIVE INFORMATION ILLUSTRATES VARIOUS
FACETS OF FIRE ACTIVITY BY ADMINISTRATIVE UNITS, SUB-
UNITS, DANGER RATINGS, AND OTHER CATEGORIES. DETAILED
TABULAR INFORMATION IS PROVIDED IN BOTH THE TEXT AND
APPENDICES.

BARNEY, RICHARD J. 08 69135
NATIONAL FIRE-DANGER RATING SYSTEM FINE-FUEL MOISTURE
CONTENT TABLES--AN ALASKAN ADAPTATION.
USDA FOREST SERV. RES. NOTE PNW-109, 12 PP., ILLUS.
THIS NOTE PRESENTS NEW FINE-FUEL MOISTURE CONTENT TABLES
DEVELOPED FOR USE WITH THE NATIONAL FIRE RATING SYSTEM
IN ALASKA. METHODS OF DEVELOPMENT AND COMPARISON WITH
STANDARD TABLES ARE DISCUSSED. THESE NEW TABLES USE DRY
BULB AND DEWPOINT TEMPERATURE AS ENTRY DATA.

BARNEY, RICHARD J. 08 69105
ROOT FEEDER SUPPRESSES FIRES.
FIRE CONTROL NOTES 30(3), PP. 11-12, ILLUS.
A FEEDING NEEDLE, NORMALLY USED BY TREE SURGEONS, WAS
EVALUATED FOR ITS POTENTIAL IN EXTINGUISHING DEEP
ORGANIC-FUEL FIRES. INITIAL RESULTS INDICATE THE NEEDLE
CAN PERFORM WELL UNDER SUCH FUEL CONDITIONS.

LUND, H. GYDE. 06 69172
APPRAISING AND MAPPING FUELS WITH AERIAL PHOTOGRAPHS.
ASP-ACSM SEMI-ANNU. CONV., PORTLAND, OREG., 1969,
PP. 173-180.
NATURAL COLOR, 1, 8,000 AERIAL PHOTOGRAPHY CAN PROVIDE A
MEANS OF MEASURING UNDERSTORY FUELS. FEASIBILITY OF
MAPPING FUELS FROM CONVENTIONAL PHOTOS IS BEING TESTED.
(NO COPIES AVAILABLE)

MURPHY, JAMES L. 12 69168
A PRELIMINARY EVALUATION OF THE FOREST FIRE PROBLEM IN THE
REPUBLIC OF CHILE AND OF THE NATIONAL PLAN OF PROTECTION
AGAINST FOREST FIRE.
COLL. FOREST RESOURCES, UNIV. WASH., 26 PP., ILLUS.
SUMMARIZES OBSERVATIONS AND PRELIMINARY CONCLUSIONS
ABOUT FOREST FIRE PROBLEMS IN CHILE AND ABOUT THE
NATIONAL PLAN FOR CONTROL OF FOREST FIRES. (NO COPIES
AVAILABLE)

MURPHY, JAMES L., *PHILPOT, CHARLES W., AND 07 69099
*GARBER, MORRIS J.
THE EFFECT OF ASPHALT AND WAX EMULSIONS ON MOISTURE CHANGES
IN SLASH.
USDA FOREST SERV. RES. PAP. PNW-81, 14 PP., ILLUS.
A LABORATORY TEST WAS CARRIED OUT TO DETERMINE THE
RELATIVE EFFECTS OF FIVE DIFFERENT COATINGS ON MOISTURE
CONTENT OF PONDEROSA PINE SLASH. SIGNIFICANT DIFFER-
ENCES WERE FOUND BETWEEN EFFECTS OF SOME OF THE COATINGS
IN BOTH THE RETARDATION OF DRYING IN GREEN SLASH AND THE
MOISTURE UPTAKE BY DRY SLASH. MIXING RATIOS AND SHADING
HAD THE GREATEST EFFECT ON DRYING RATES AND MADE LITTLE
DIFFERENCE IN WATER REPELLENCY. FIELD STUDY IS NEEDED.

NOSTE, NONAN V. 12 69151
ANALYSIS AND SUMMARY OF FOREST FIRES IN COASTAL ALASKA.
PACIFIC NORTHWEST FOREST AND RANGE EXP. STA., 12 PP.,
ILLUS.
COASTAL ALASKA'S FIRE OCCURRENCE AND ACREAGE BURNED
RECORD FROM 1956 TO 1967 WAS STUDIED TO IDENTIFY AND
DESCRIBE INFLUENCING FACTORS. INDIVIDUAL FIRE REPORTS
FROM REGION 1C OF THE FOREST SERVICE WERE ANALYZED
AND SUMMARIZED. THE STUDY PROVIDES INFORMATION ON
AREA, CAUSE, FUEL, AND FIRE DANGER AS RELATED TO A
NORMALLY LIGHT FIRE LOAD.

*TRIGG, WILLIAM M., AND NOSTE, NONAN V. 01 69041
SUMMARY AND ANALYSIS OF FIRE DANGER INDEXES FOR SELECTED
COASTAL ALASKA STATIONS.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STA., 21 PP., ILLUS.

THE OPPORTUNITY EXISTED TO GENERATE A HISTORY OF NATIONAL FIRE DANGER RATING SYSTEM SPREAD AND BUILDUP INDEXES FROM U.S. WEATHER BUREAU OBSERVATION RECORDS FOR COASTAL ALASKA. ANALYSIS SHOWED THAT INDIVIDUAL STATIONS HAVE CHARACTERISTIC INDEX VALUES. FIRE DANGER SUMMARIES FOR INDIVIDUAL STATIONS ARE PROVIDED TO GIVE INFORMATION FOR LOCAL DEVELOPMENT OF ACTION AND MANNING GUIDES, SCHEDULES FOR FIRE PLANNING, AND FIRE SEASON EVALUATION.

FISH, WILDLIFE, AND TIMBER

*BLACK, HUGH C., DIMOCK, EDWARD J., II, *DODGE, WENCELL E., AND *LAWRENCE, WILLIAM H. 12 69162
SURVEY OF ANIMAL DAMAGE ON FOREST PLANTATIONS IN OREGON AND WASHINGTON.

THIRTY-FOURTH N. AMER. WILDLIFE NATUR. RESOURCES CONF. TRANS. 1969, PP. 388-408, ILLUS.

ANIMAL DAMAGE MARKEDLY REDUCED THE HEIGHT GROWTH OF UNPROTECTED SEEDLINGS. AFTER 4 YEARS, THE MEAN HEIGHT OF UNCAGED DOUGLAS-FIR TREES IN THE FIRST SERIES IN OREGON AND WASHINGTON WAS 23.4 INCHES, COMPARED WITH MEAN HEIGHT FOR CAGED SEEDLINGS OF 33.1 INCHES. BROWSING BY DEER WAS THE MOST COMMON SOURCE OF ANIMAL DAMAGE ON ALL PLOTS. ANIMALS THAT INJURED SEEDLINGS, RANKED BY FREQUENCY OF DAMAGE IN 1968, WERE BIG GAME, HARES AND RABBITS, GROUSE, MOUNTAIN BEAVERS, POCKET GOPHERS, DOMESTIC STOCK, PORCUPINES, MICROTINE RODENTS, AND MOLES.

CROUCH, GLENN L. 03 69053
ANIMAL DAMAGE TO CONIFERS ON NATIONAL FORESTS IN THE PACIFIC NORTHWEST REGION...

U.S.D.A. FOREST SERV. RESOURCE BULL. PNW-28, 13 PP., ILLUS.

ANIMAL DAMAGE TO GROWING TREES WAS MORE COMMON ON OREGON NATIONAL FORESTS THAN ON WASHINGTON NATIONAL FORESTS. MORE PROBLEM AREAS WERE REPORTED FROM WESTERN OREGON THAN WESTERN WASHINGTON OR EAST-SIDE FORESTS. REGION-WIDE, FOLIAGE BROWSING WAS THE MOST COMMON TYPE OF DAMAGE, FOLLOWED IN ORDER BY BARKING, ROOT GNAWING, CLIPPING, TRAMPLING, AND LOSS OF TREES. PROBLEM ANIMALS IN ORDER OF IMPORTANCE WERE DEER, PORCUPINE, GOPHERS, HARE AND RABBITS, ELK, LIVESTOCK, SMALL RODENTS, MOUNTAIN BEAVER, AND BEAR.

CROUCH, GLENN L. 12 69183
DEER AND REFORESTATION IN THE PACIFIC NORTHWEST.
WILDLIFE AND REFORESTATION IN THE PACIFIC NORTHWEST SYMP. PROC. 1968, PP. 63-66.
THIS PAPER IS A REVIEW OF PRESENT KNOWLEDGE OF DEER-REFORESTATION INTERACTIONS AND PROBLEMS IN THE PACIFIC NORTHWEST. THE OCCURRENCE AND SEASONAL DISTRIBUTION OF BROWSING ON SEEDLINGS BY DEER ARE DESCRIBED AND FACTORS THAT INFLUENCE BROWSING ARE CONSIDERED. BROWSING EFFECTS AND METHODS, BOTH CURRENTLY AVAILABLE AND POTENTIAL, FOR CONTROLLING BROWSING ARE ALSO DISCUSSED.

DIMOCK, EDWARD J., II. 10 69170
FEEDING PREFERENCE BY SNOWSHOE HARE AND BLACK-TAILED DEER FOR DIFFERING DOUGLAS-FIR GENOTYPES. (ABSTR.)
ANNU. MEETING WEST. FOREST GENETICS ASS. 1969, 1 P. (NO COPIES AVAILABLE)

DIMOCK, EDWARD J., II, AND BLACK, HUGH C. 12 69182
SCOPE AND ECONOMIC ASPECTS OF ANIMAL DAMAGE IN CALIFORNIA, OREGON, AND WASHINGTON.
WILDLIFE AND REFORESTATION IN THE PACIFIC NORTHWEST SYMP. PROC. 1968, PP. 10-14.
HOW DO LAND MANAGERS ASSESS DAMAGE CAUSED BY ANIMALS ON PUBLIC AND PRIVATE FORESTS IN CALIFORNIA, OREGON, AND WASHINGTON. ESTIMATES OF TIMBER VOLUMES LOST AND OF ANIMALS CHIEFLY RESPONSIBLE VARY CONSIDERABLY--REFLECTING A DIVERSITY OF PROBLEMS BY LOCALITY AND LANDOWNERSHIP, AS WELL AS DIFFERING APPROACHES TO APPRAISING DAMAGE.

HENDREE, JOHN C. 12 69169
APPRECIATIVE VERSUS CONSUMPTIVE USES OF WILDLIFE REFUGES; STUDIES OF WHO GETS WHAT AND TRENDS IN USE.
THIRTY-FOURTH N. AMER. WILDLIFE AND NATUR. RESOURCES CONF. TRANS., 1969, PP. 252-264.
APPRECIATIVE VERSUS CONSUMPTIVE (HUNTING AND FISHING) TYPES OF RECREATION ARE COMPARED AS TO, (1) WHO PARTICIPATES IN THE TWO TYPES OF USE, (2) WHAT INTANGIBLE BENEFITS ARE GAINED, (3) WHAT ARE TRENDS IN PARTICIPATION. SUCH INFORMATION IS VITAL TO POLICY DECISIONS WHERE TRADE-OFFS BETWEEN THE TWO TYPES OF USE MUST BE MADE.

MEEHAN, W. R., FARR, W. A., *BISHOP, D. M., AND *PATRIC, J. H. 09 69137
SOME EFFECTS OF CLEARCUTTING ON SALMON HABITAT OF TWO SOUTHEAST ALASKA STREAMS.

USDA FOREST SERV. RES. PAP. PNW-82, 45 PP., ILLUS.
THE EFFECTS OF CLEARCUTTING ON STREAMFLOW, SUSPENDED SEDIMENT, STREAM TEMPERATURE, LOG-DEBRIS JAMS, AND INDIRECTLY ON SALMON POPULATIONS OF TWO WATERSHEDS WERE EVALUATED AND COMPARED WITH AN UNCUT WATERSHED IN SOUTHEAST ALASKA. ALTHOUGH SOME EFFECTS WERE OBSERVED, THE TIMBER HARVEST AS PRACTICED ON THESE WATERSHEDS DID NOT APPEAR HARMFUL TO SALMON HABITAT OR POPULATIONS.

RADWAN, M. A. 01 69015
ANIMAL REPELLENTS--EFFECTS ON SOILS, TREES, AND TREE STORAGE.

WEST. FOREST. CONSERV. ASS. WEST. FOREST NURSERY COUNCIL PROC. 1968, PP. 65-67.
UNDER NORMAL NURSERY CONDITIONS, SPRAYING DORMANT PLANTING STOCK WITH AVAILABLE REPELLENTS AT THE RECOMMENDED RATES APPEARS TO BE SAFE FOR BOTH NURSERY SOILS AND TREES. ALSO, COLD STORAGE IS SAFE FOR TREATED TREES ALTHOUGH IT CAUSES HIGH LOSSES OF THE REPELLENT FROM THE TREES AND CONSEQUENTLY MUCH REDUCTION IN THEIR REPELLENCY.

RADWAN, M. A. 03 69029
CHEMICAL COMPOSITION OF THE SAPWOOD OF FOUR TREE SPECIES IN RELATION TO FEEDING BY THE BLACK BEAR.

FOREST SCI. 15, PP. 11-16.

CHEMICAL COMPOSITION OF SAPWOOD FROM FOUR TREE SPECIES WAS STUDIED IN RELATION TO SPRING BEAR DAMAGE IN WESTERN WASHINGTON. SPECIES DIFFERED PRINCIPALLY IN SUGAR CONTENT WHICH APPEARED AS THE MOST PROBABLE BASIS FOR BEAR'S PREFERENCE WHEN DAMAGE OCCURRED, DID NOT EXPLAIN NONDAMAGE AREAS.

RADWAN, M. A. 10 69173
EFFECTS OF ESSENTIAL OILS FROM THREE DOUGLAS-FIR CLONES ON CELLULOSE DIGESTIBILITY BY DEER RUMEN IN VITRO. (ABSTR.)
ANNU. MEETING WEST. FOREST GENETICS ASS. 1969, 1 P. (NO COPIES AVAILABLE)

RADWAN, M. A. 12 69184
PROTECTION OF CONIFEROUS SEEDS FROM RODENTS.
WILDLIFE AND REFORESTATION IN THE PACIFIC NORTHWEST SYMP. PROC. 1968, PP. 52-54.
METHODS FOR PROTECTING CONIFEROUS SEED FROM RODENTS ARE REVIEWED. THESE INCLUDE MECHANICAL DEVICES, POISON BAITS, TOXICANTS AND REPELLENTS, AND BIOLOGICAL CONTROL. THE REVIEW SUGGESTS THE NEED FOR STRENGTHENING RESEARCH ON THE PROTECTION OF SEEDS, BECAUSE TODAY, AVAILABLE METHODS FOR THE CONTROL OF RODENTS ARE INADEQUATE.

RADWAN, M. A. 12 69149
TMD WILD MAMMAL REPELLENT, REVIEW AND CURRENT STATUS.
FOREST SCI. 15, PP. 439-445.
TMD PROPERTIES, ASSAY METHODS, AND USE AS A REPELLENT AGAINST WILD MAMMALS ARE REVIEWED. THE REVIEW SUGGESTS THAT TMD IS A VERY USEFUL ANIMAL REPELLENT, ALTHOUGH FURTHER RESEARCH IS NEEDED.

SMITH, JUSTIN. 01 69064
ASSOCIATED PLANT SPECIES IMPORTANT TO THE WILDLIFE FORAGE PROGRAM ON TIMBERED RANGES OF THE NORTHWEST.
RANGE MANGE. WORKSHOP PROC., WSU, PULLMAN, WASH., PP. 81-82. (NO COPIES AVAILABLE)

GENERAL

ANONYMOUS. 05 69060
PORTLAND-HEADQUARTERS FOR U.S. FOREST SERVICE RESEARCH IN THE PACIFIC NORTHWEST.
GREATER PORTLAND COMMERCE 53(18), PP. 46-47, ILLUS. (NO COPIES AVAILABLE) (PREPARED BY CHARLES J. NEWLON)
LOG EXPORTS, LUMBER AND PLYWOOD PRICES, TIMBER MANAGEMENT PRACTICES, AND POLLUTION OF THE FOREST ENVIRONMENT ARE MAKING TODAY'S HEADLINES. THESE ARE AMONG THE MANY FOREST-ORIENTED TOPICS CONCERNING THE 152 SCIENTISTS OF THE PORTLAND-BASED U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE RESEARCH UNIT, THE PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION. ARTICLE BRIEFLY DESCRIBES SOME OF THE STATION'S MANY CURRENT RESEARCH PROGRAMS IN OREGON, WASHINGTON, AND ALASKA.

FWLER, WILLIAM B. 03 69043
A DIGITAL INDICATOR FOR MAXIMUM WINDSPEEDS.
U.S.D.A. FOREST SERV. RES. NOTE PNW-98, 4 PP., ILLUS.
A SIMPLE DEVICE FOR INDICATING MAXIMUM WINDSPEED DURING A TIME INTERVAL IS DESCRIBED. USE OF A UNIJUNCTION TRANSISTOR, FOR VOLTAGE SENSING, RESULTS IN A STABLE COMPARISON CIRCUIT AND ALSO REDUCES OVERALL COMPONENT REQUIREMENTS. MEASUREMENT IS PRESENTED DIGITALLY IN 1-MILE-PER-HOUR INCREMENTS OVER THE RANGE OF 0-51 M.P.H.

FOWLER, WILLIAM B. 01 69010
A DIGITAL TEMPERATURE MONITOR FOR PHOTORECORDING.
 U.S.D.A. FOREST SERV. RES. NOTE PNW-95, 7 PP., ILLUS.
 A METHOD OF DIGITIZING ATMOSPHERIC MEASUREMENTS FOR POR-
 TRAYAL WITH A TIME-LAPSE CAMERA IS DESCRIBED. A SERVO-
 MECHANISM REBALANCES A RESISTANCE BRIDGE WHICH HAS THE
 TEMPERATURE SENSOR AS AN ACTIVE COMPONENT. A MECHANI-
 CALLY COUPLED ENCODER DETERMINES THE PROPER COMBINATION
 OF RELAY CLOSURES WHICH, IN TURN, CAUSES THE TEMPERATURE
 TO BE PROJECTED BY MEANS OF A LIGHT BANK.

MASON, RICHARD R. 03 69028
A SIMPLE TECHNIQUE FOR MEASURING CLEORESIN EXUDATION FLOW
 IN PINES.
 FOREST SCI. 15, PP. 56-57, ILLUS.
 OLEORESIN IS A FACTOR IN REPELLING THE ATTACKS OF SOME
 TREE-KILLING BARK BEETLES. QUANTITATIVE CHARACTERISTICS
 OF RESIN CAN BE ESTIMATED IN PINES BY MEASURING THE
 INITIAL RATE OF OLEORESIN EXUDATION FLOW THROUGH A
 CAPILLARY TUBE INSERTED IN THE SAPWOOD. SUCH MEASURE-
 MENTS ARE A QUICK AND INEXPENSIVE WAY OF EVALUATING
 RESIN POTENTIAL THAT MAY BE RELATED TO RESISTANCE OF
 DIFFERENT TREES TO CERTAIN BARK BEETLES.

NEWTON 'NEWTON,' CHARLES. 12 68161
REPORT OF ACTIVITIES--U.S. FOREST SERVICE, PACIFIC NORTHWEST
 FOREST AND RANGE EXPERIMENT STATION.
 47TH ANNU. WASH. STATE FOREST. CONF. PRCC. 1968,
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ANNOTATED LIST OF PUBLICATIONS OF THE PACIFIC NORTHWEST
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 10 PP.

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ANNUAL REPORT, 1968.
 44 PP., ILLUS.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STA. 03 69007
LIST OF AVAILABLE PUBLICATIONS, NC. 1 1969.
 2 PP., WITH ANNOTATIONS.

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LIST OF AVAILABLE PUBLICATIONS, NC. 2 1969.
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PACIFIC NORTHWEST FOREST AND RANGE EXP. STA. 12 69143
LIST OF AVAILABLE PUBLICATIONS, NC. 4 1969.
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SCHALLAU, CON, AND *NEWPORT, CARL A. 04 69052
UNITERM COORDINATE INDEXING--A SYSTEM FOR MAINTAINING
 REFERENCE COLLECTIONS.
 J. FOREST. 67, PP. 246-247, ILLUS.
 DESCRIBES HOW AUTHORS UTILIZE UNITERM COORDINATE SYSTEM
 FOR INFORMATION STORAGE AND RETRIEVAL.

ZASADA, JOHN C., AND *ZAHNER, ROBERT. 12 69160
VESSEL ELEMENT DEVELOPMENT IN THE EARLYWOOD OF RED OAK
 ('QUERCUS RUBRA').
 CAN. J. BOT. 47, PP. 1965-1971, ILLUS., PLUS PLATES I, II.
 EARLYWOOD FORMATION WAS OBSERVED IN 60-YEAR-OLD FOREST-
 GROWN RED OAK TREES IN SOUTHERN MICHIGAN. (NO COPIES
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GENETICS

COPES, DONALD. 04 69079
EFFECT OF GRAFT TYPE ON 6-MONTH SCION SURVIVAL OF FIELD
 GROWN DOUGLAS-FIR GRAFTS.
 U.S.D.A. FOREST SERV. RES. NOTE PNW-104, 5 PP., ILLUS.
 A STUDY ON FIELD SURVIVAL AFTER 6 MONTHS OF TOPLEFT,
 SPLICE, AND SIDE GRAFTS REVEALED THAT GRAFT TYPE AND
 TECHNIQUE WERE NOT SIGNIFICANT SOURCES OF VARIATION
 WHEN 80 MM. OR MORE OF CAMBIAL CONTACT CONNECTED THE
 STOCK AND SCION.

COPES, DONALD. 03 69047
GRAFT UNION FORMATION IN DOUGLAS-FIR.
 AMER. J. BOT. 56(3), PP. 285-289, ILLUS.
 IN MOST RESPECTS, GRAFTS OF DOUGLAS-FIR FOLLOWED DEVEL-
 OPMENT PATTERNS PREVIOUSLY REPORTED FOR SPRUCE AND PINE
 GRAFTS, BUT SPECIFIC DIFFERENCES WERE NOTED IN CONTRIB-
 UTING CELL TYPES, TIME OF FORMATION, AND MODE OF HEAL-
 ING.

COPES, DONALD. 01 69066
REMEDY FOR GRAFT INCOMPATIBILITY IN DOUGLAS-FIR SEED
 ORCHARDS.
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 ASS. WEST. REFOREST. COORDINATING COMM. PRCC. 1968, PP.
 19-22, ILLUS.
 TWO METHODS ARE PROPOSED FOR COUNTERING GRAFT INCOMPAT-
 IBILITY LOSSES IN NEW ORCHARDS. ONE METHOD TESTS ALL
 STOCK-SCION COMBINATIONS, WHILE THE OTHER METHOD TESTS
 A 1C-12 GRAFT SAMPLE OF EACH NEW PARENT.

COPES, DONALD L. 10 69171
THE RELATIONSHIP BETWEEN DOUGLAS-FIR GRAFT COMPATIBILITY AND
 WOOD SPECIFIC GRAVITY. (ABSTR.)
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SILEN, ROY R., AND *KEANE, GENE. 03 69045
COOLING A DOUGLAS-FIR SEED ORCHARD TO AVOID POLLEN
 CONTAMINATION.
 U.S.D.A. FOREST SERV. RES. NOTE PNW-101, 10 PP.
 A VERY COLD WATER SPRAY WAS USED IN A DOUGLAS-FIR SEED
 ORCHARD TO REDUCE POLLEN CONTAMINATION BY ARRESTING
 FLORAL BUDS IN THEIR SCALES DURING PERIOD OF LOCAL
 POLLEN RELEASE. NUMBERS OF POLLEN GRAINS PER CONE WERE
 THEREBY REDUCED FROM OVER 1,300 ON CONTROL PLOTS TO A
 TOLERABLE 100 OR LESS ON SPRAYED PLOTS.

SORENSEN, FRANK. 07 69119
EMBRYONIC GENETIC LOAD IN COASTAL DOUGLAS-FIR, 'PSEUDOTSUGA
 MENZIESII' VAR. 'MENZIESII.'
 AMER. NATUR. 103(932), PP. 389-398, ILLUS.
 INBREEDING EMBRYONIC LOADS OF 2.3 TO 27.6 LETHAL
 EQUIVALENTS (MEDIAN 9 OR 10) WERE ESTIMATED FOR 35
 COASTAL DOUGLAS-FIR TREES USING COMPARISON OF SEED SET
 FOLLOWING SELF- AND CROSS-POLLINATION.

VIERECK, LESLIE A., AND FOOTE, JOAN. 12 68165
THE STATUS OF BALSAM POPLAR ('POPULUS BALSAMIFERA') AND
 BLACK COTTONWOOD ('POPULUS TRICHOCARPA') IN ALASKA.
 (ABSTR.)
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BECKWITH, R. C. 12 68166
THE LARGE ASPEN TORTRIX, 'CHORISTONEURA CONFLICTANA' IN
 INTERIOR ALASKA. (ABSTR.)
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DATERMAN, G. E. 04 69054
EASY RECOGNITION OF MATED FEMALES OF THE EUROPEAN PINE SHOOT
 MOTH.
 J. ECON. ENTOMOL. 62(2), PP. 527-528, ILLUS.
 MATED EUROPEAN PINE SHOOT MOTH FEMALES CAN BE DISTIN-
 GUISHED FROM UNMATED INDIVIDUALS BY THE APPEARANCE OF
 THE VENTRAL PORTION OF THE ABDOMINAL TIP. THIS CONDI-
 TION RESULTS FROM THE REMOVAL OF SCALES BY THE RUBBING
 ACTION OF MALE VALVAE DURING COUPULATION. MAGNIFICATION
 IS USUALLY NOT NECESSARY TO PERCEIVE THIS FEATURE, AND
 DETERMINATION OF FEMALE MATING STATUS CAN EASILY BE
 MADE UNDER FIELD CONDITIONS.

MASON, RICHARD R. 12 69148
BEHAVIOR OF IPS POPULATION AFTER SUMMER THINNING IN A
 LOBLOLLY PINE PLANTATION.
 FOREST SCI. 15, PP. 390-398.
 CONCLUDES THAT IN PULPWOOD STANDS IN THE MID-SOUTH,
 IPS ARE RARELY A HAZARD TO HEALTHY LIVING TREES
 BECAUSE OF SUMMER THINNING.

MASON, RICHARD R. 04 69076
SEQUENTIAL SAMPLING OF DOUGLAS-FIR TUSSOCK MOTH POPULATIONS.
 U.S.D.A. FOREST SERV. RES. NOTE PNW-102, 11 PP., ILLUS.
 SEQUENTIAL PLANS HAVE BEEN CONSTRUCTED FOR SAMPLING EGGS
 AND LARVAE OF THE DOUGLAS-FIR TUSSOCK MOTH. THE PLANS
 ARE A STANDARDIZED METHOD FOR MAKING QUICK GROUND
 SURVEYS TO DISTINGUISH CURRENTLY INCREASING POPULATIONS
 FROM THOSE HAVING OUTBREAK POTENTIAL.

MITCHELL, R. G., AND *NAGEL, W. P. 11 69145
TREE SELECTION FOR CONTROLLING MIDGES ON DOUGLAS-FIR.
 AMER. CHRISTMAS TREE J. 13(4), PP. 11-13, ILLUS.
 LATENESS OF BUD BURST IN DOUGLAS-FIR HAS BEEN FOUND COR-
 RELATED WITH REDUCED INTENSITY OF INFESTATION BY A COM-
 PLEX OF NEEDLE-MINING MIDGES IN THE GENUS 'CONTARINIA.'
 THIS PHENOMENON SUGGESTS A METHOD OF CONTROL IN
 CHRISTMAS TREE PLANTATIONS THROUGH GENETIC MANIPULATION
 OF PLANTING STOCK.

- WERNER, RICHARD A. 10 69136
DEVELOPMENT OF THE BLACK-HEADED BUDWORM IN THE LABORATORY.
J. ECON. ENTOMOL. 62(5), PP. 1050-1052.
BUDWORMS REACH MATURITY FROM LABORATORY-LAID EGGS 30 DAYS
SOONER THAN FIELD-REARING. AT LEAST TWO GENERATIONS,
PERHAPS THREE, PER YEAR ARE POSSIBLE IN LABORATORY.
WESTERN HEMLOCK IS PREFERRED OVER SITKA SPRUCE FOR HOST.
- WERNER, RICHARD A. 03 69046
THE AMOUNT OF FOLIAGE CONSUMED OR DESTROYED BY LABORATORY-
REARED LARVAE OF THE BLACK-HEADED BUDWORM, 'ACLERIS
VARIANA.'
CAN. ENTOMOL. 101(3), PP. 286-290.
SITKA SPRUCE PRODUCES TWICE AS MANY NEEDLES PER LINEAR
INCH OF TWIG AS WESTERN HEMLOCK. DEFOLIATION BY THE
BLACK-HEADED BUDWORM, 'ACLERIS VARIANA' (FERN.), IS MORE
SEVERE ON HEMLOCK THAN SPRUCE BECAUSE OF DIFFERENCES IN
THE PHENOLOGICAL DEVELOPMENT OF THE HOSTS AND IN THE
FEEDING BEHAVIOR OF FIRST- AND SECOND-INSTAR LARVAE ON
EACH OF THE HOSTS.
- WICKMAN, BOYD E. 10 69164
A CROSSBREEDING STUDY OF THE CEDAR TREE BORER, 'SEMANOTUS
LIGNEUS AMPLUS,' AND THE FIR TREE BORER, 'S. LITIGIOSUS.'
PAN-PACIFIC ENTOMOL. 45, PP. 282-285.
REPORTS THAT THESE TWO SPECIES WILL CROSSMATE AND
FEMALES OF RECIPROCAL CROSSES PRODUCE VIABLE EGGS.
HOWEVER, DUE TO UNCONTROLLABLE HIGH TEMPERATURES ALL
LARVAE DIED DURING THE STUDY.
- WRIGHT, KENNETH H. 01 69069
RESEARCH PROGRAM FOR REDUCTION OF PEST IMPACT.
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CONSERV. ASS. WEST. FOREST PEST COMM. ANNUAL MEETING 1968,
PP. 17-20.
A RESEARCH PROGRAM FOR REDUCING PEST IMPACT SHOULD TAKE
INTO ACCOUNT PRIORITIES, BASED ON THE MAGNITUDE OF IM-
PACTS, WHERE THEY ARE OCCURRING AND THE POTENTIAL FOR
REDUCING THEM.
- ## LOGGING
- BINKLEY, VIRGIL W. 12 69178
PLANNING SINGLE-SPAN SKYLINES.
SKYLINE LOGGING SYMP. PROC. 1969, PP. 63-65.
SINGLE-SPAN SKYLINES REQUIRE CAREFUL AND THOROUGH
PLANNING USING CRITERIA DEFINING AREAS SUITABLE FOR THIS
YARDING SYSTEM. PLANNING A SKYLINE YARDING SYSTEM WILL
REQUIRE HIGHLY TRAINED PERSONNEL AND WILL GENERALLY BE
MORE COSTLY THAN PLANNING RELATED TO CONVENTIONAL
YARDING METHODS.
- CAMPBELL, CHARLES O. 12 69180
MECHANICS OF SKYLINE ANCHORING.
SKYLINE LOGGING SYMP. PROC. 1969, PP. 34-40, ILLUS.
AN ADEQUATE TAILHOLD IS NECESSARY FOR ANY SKYLINE
INSTALLATION. KNOWLEDGE OF THE MECHANICS OF SKYLINE
ANCHORING WILL BE HELPFUL IN OBTAINING A SECURE TAILHOLD.
- CARSON, WARD WM. 12 69179
COMPUTER DESIGN OF SINGLE-SPAN SKYLINES.
SKYLINE LOGGING SYMP. PROC. 1969, PP. 41-47, ILLUS.
THIS PAPER DISCUSSES THE COMPUTER AIDS AVAILABLE TO THE
DESIGNER OF SINGLE-SPAN SKYLINES. THE DIFFERENT FORMU-
LATIONS OF THE PROBLEM ARE DISCUSSED, AND THEIR ACCURACY
IS COMPARED.
- LYSONS, HILTON H. 06 69098
GRAPPLE YARDING REVOLUTIONIZES LOGGING.
WESTERN CONSERV. J. 26(3), PP. 26-27, ILLUS.
POINTS OUT HOW THE RUNNING SKYLINE, GRAPPLE YARDING SYS-
TEM, THE NEXT GENERATION IN LOGGING EQUIPMENT, IS MAKING
REVOLUTIONARY CHANGES IN THE WOODS TODAY.
- MANN, CHARLES N. 12 69181
MECHANICS OF RUNNING SKYLINES.
SKYLINE LOGGING SYMP. PROC. 1969, PP. 48-51, ILLUS.
PRESENTS A GENERAL DESCRIPTION OF THE RUNNING SKYLINE
SYSTEM, AND A MATHEMATICAL ANALYSIS BASED ON USE OF
COEFFICIENTS DEVELOPED FOR THE SOLUTION OF STANDING
SKYLINE PROBLEMS. (NO COPIES AVAILABLE)
- MANN, CHARLES N. 01 69003
MECHANICS OF RUNNING SKYLINES.
U.S.D.A. FOREST SERV. RES. PAP. PNW-75, 11 PP., ILLUS.
PRESENTS A GENERAL DESCRIPTION OF RUNNING SKYLINE SYS-
TEMS AND EASY-TO-USE PROCEDURES FOR DETERMINING THE
PAYLOAD CAPABILITY OF ANY CONFIGURATION. INTENDED PRI-
MARILY AS A PRACTICAL TOOL FOR THOSE WHO PLAN RUNNING
SKYLINE OPERATIONS. INCLUDED IS A MATHEMATICAL DERIVA-
TION OF THE PROCEDURES AS PRESENTED ON THE WORKSHEETS
FOR THOSE INTERESTED IN A FULL UNDERSTANDING OF THE
MECHANICS OF RUNNING SKYLINES.
- PACIFIC NORTHWEST FOREST AND RANGE EXP. STA. 01 69002
GLOSSARY OF CABLE LOGGING TERMS.
7 PP.

MENSURATION

- BRUCE, DAVID. 02 69044
CHARTS FOR DETERMINING SAMPLING RATE AND NUMBER IN SAMPLE.
U.S.D.A. FOREST SERV. RES. NOTE PNW-97, 6 PP., ILLUS.
FOUR CHARTS ARE PRESENTED THAT SHOW SAMPLING RATE AND
NUMBER IN SAMPLE FOR DIFFERENT DESIRED LEVELS OF ACCU-
RACY WHEN NUMBER IN POPULATION AND COEFFICIENT OF VARIA-
TION CAN BE ESTIMATED.
- BRUCE, DAVID. 12 69147
POTENTIAL PRODUCTION IN THINNED DOUGLAS-FIR PLANTATIONS.
USDA FOREST SERV. RES. PAP. PNW-87, 22 PP., ILLUS.
NINE FOREIGN PRODUCTION TABLES FOR DOUGLAS-FIR SUGGEST
THAT POTENTIAL YIELDS OF THINNED STANDS ARE HIGHER THAN
PREVIOUSLY ESTIMATED ON BASIS OF NATURAL STANDS.
- LUND, H. GYDE. 01 69011
FACTORS FOR COMPUTING PHOTO COVERAGE.
PHOTOGRAM. ENG. 35, PP. 61-63.
PROVIDES PROCEDURES AND TABLES FOR QUICK DETERMINATION
OF THE NUMBER OF VERTICAL AERIAL PHOTOGRAPHS REQUIRED
TO COVER AN AREA AT ANY SCALE, OVERLAP, AND SIDELAP
WITH THE MOST COMMON PHOTO FORMATS. DIMENSIONS OF AREA
MAY BE EXPRESSED IN FEET, METERS, MILES, OR KILOMETERS.
- ## PATHOLOGY
- *ADAMS, D. H., AND *ROTH, L. F. 12 69153
INTRASPECIFIC COMPETITION AMONG GENOTYPES OF FOMES
CAJANDERI DECAYING YOUNG-GROWTH DOUGLAS-FIR.
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- *FASSI, BRUNO, *FONTANA, ANNA, AND TRAPPE, JAMES M. 05 69114
ECOTHYCORRHIZAE FORMED BY ENDOGENE LACTIFLUA WITH SPECIES
OF PINUS AND PSEUDOTSUGA.
MYCOLOGIA 61, PP. 412-414.
THE FUNGUS 'ENDOGONE LACTIFLUA' FORMS MYCORRHIZAE WITH
DOUGLAS-FIR AND PINES IN BOTH AMERICAN AND EUROPEAN
NURSERIES. A MICROSCOPIC STAINING PROCEDURE CAN BE
USED ON MYCORRHIZAE TO IDENTIFY THIS WIDELY DISTRIBUTED
FUNGUS.
- KNUTSON, D. M. 08 69122
EFFECT OF TEMPERATURE AND RELATIVE HUMIDITY ON LONGEVITY
OF STORED DWARF MISTLETOE SEEDS. (ABSTR.)
PHYTOPATHOL. 59, P. 1035. (NO COPIES AVAILABLE)
- *LI, C. Y., LU, K. C., NELSON, E. E., BOLLEN, 12 69163
W. B., AND TRAPPE, J. M.
EFFECT OF PHENOLIC AND OTHER COMPOUNDS ON GROWTH OF 'PORIA
WEIRII' IN VITRO.'
MICROBIOS 3, PP. 305-311, ILLUS.
PHENOLIC COMPOUNDS IN PLANT TISSUES ARE WIDELY
ASSOCIATED WITH RESISTANCE TO DISEASE. IN LABORATORY
EXPERIMENTS, NINE OUT OF 25 SUCH COMPOUNDS MARKEDLY
INHIBITED GROWTH OF 'PORIA WEIRII,' A SERIOUS PATHOGEN
OF CONIFER ROOTS. THESE RESULTS WILL SERVE AS A BASIS
FOR RESEARCH ON THE MECHANISMS OF RESISTANCE TO 'P.
WEIRII' AND ITS BIOLOGICAL CONTROL.
- *LI, C. Y., LU, K. C., TRAPPE, J. M., AND 07 69106
BOLLEN, W. B.
A SIMPLE, QUANTITATIVE METHOD OF ASSAYING SOIL FOR INHIBI-
TORY FUNGI.
USDA FOREST SERV. RES. NOTE PNW-108, 3 PP., ILLUS.
MICRO-ORGANISMS ISOLATED FROM SOIL CAN BE EASILY
TESTED FOR INHIBITION OF ROOT PATHOGENS SUCH AS 'PORIA
WEIRII.' THE ISOLATES ARE TRANSFERRED BY TOOTHPIKE
PROBES TO THE SURFACE OF A DOUBLE-LAYERED AGAR PLATE
CONTAINING PATHOGEN MYCELIUM SANDWICHED BETWEEN THE
AGAR LAYERS. THE PATHOGEN DOES NOT GROW UNDER INHIBI-
TORY ORGANISMS.
- LU, K. C. 01 69014
EFFECT OF ORGANIC AMENDMENTS ON SOIL MICROFLORA IN RELATION
TO FUSARIUM ROOT ROT OF PONDEROSA PINE SEEDLINGS.
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MICROBIAL POPULATIONS IN ALL AMENDED PLOTS WERE SIGNIFI-
CANTLY HIGHER THAN THOSE OF THE CONTROL PLOT, POSSIBLY
ACCOUNTING FOR THE REDUCTION IN DISEASE ASSOCIATED WITH
AMENDMENT.
- NELSON, EARL E. 03 69032
OCCURRENCE OF FUNGI ANTAGONISTIC TO PORIA WEIRII IN A
DOUGLAS-FIR FOREST SOIL IN WESTERN OREGON.
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FIVE FUNGI ISOLATED FROM SOIL BY THE DILUTION PLATE
TECHNIQUE, ABOUT 6.7 PERCENT OF TOTAL FUNGI COUNTED,
WERE ANTAGONISTIC TO 'PORIA WEIRII' ON MALT AGAR. TOTAL
FUNGUS COUNTS FLUCTUATED SEASONALLY, DEPENDING CHIEFLY
UPON SOIL MOISTURE CONTENT.

- NELSON, EARL E. 02 69025
 *PORIA WEIRII, WHERE ARE WE AND WHERE DO WE GO FROM HERE.
 (ABSTR.)
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- *PEYRONEL, BENIAMINO, *FASSI, BRUNO, *FONTANA, ANNA, 5 69104
 AND TRAPPE, JAMES M.
 TERMINOLOGY OF MYCORRHIZAE.
 MYCOLOGIA 61(2), PP. 410-411.
 THE TERMS 'ECTOMYCORRHIZA,' 'ENDOMYCORRHIZA,'
 AND 'ECTENDOMYCORRHIZA' ARE PROPOSED FOR DENOT-
 ING DIFFERENT KINDS OF MYCORRHIZAL STRUCTURES.
 THESE TERMS ARE SHORTER AND MORE ACCURATE THAN
 THE TERMS USED HERETOFORE.
- SHEA, KEITH R., AND *HOWARD, BENTON. 01 69071
 DWARF MISTLETOE CONTROL--A PROGRAM FOR RESEARCH AND DEVELOP-
 MENT IN THE WEST.
 IN 'WESTERN FOREST PEST CONDITIONS.' WEST. FOREST. AND
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 A WEST-WIDE PROGRAM FOR RESEARCH AND DEVELOPMENT NOW
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 AGRICULTURE, RESEARCH PATHOLOGISTS AND PEST CONTROL
 EXPERTS IS OUTLINED. THE OBJECTIVE OF THE COORDINATED
 PROGRAM IS TO PROVIDE IMPROVED PRACTICES FOR CONTROL-
 LING DWARF MISTLETOES OF THE PRINCIPAL WESTERN CONIFERS.
- *THIERS, HARRY D., AND TRAPPE, JAMES M. 07 69156
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 FIVE NEW SPECIES OF FUNGI THAT FORM MYCORRHIZAE
 WITH CONIFER ROOTS ARE NAMED AND DESCRIBED FROM
 THE PACIFIC COASTAL STATES. THESE FUNGI ARE OF
 PARTICULAR PHYLOGENETIC SIGNIFICANCE, IN THAT THEY
 COMPRISE A CONNECTING LINK BETWEEN MUSHROOMS IN
 THE FAMILY BOLETACEAE AND PUFFBALLS (GASTEROMYCETES).
- TRAPPE, JAMES M. 02 69059
 COMMENTS ON SZEMERE'S 'DIE UNTERIRDISCHEN PILZE DES
 KARPATENBECKENS.'
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 CONFUSION IN CLASSIFICATION AND CITATION OF SPECIES.
- TRAPPE, JAMES M. 05 69126
 MYCORRHIZAE.
 MCGRAW-HILL YEARBOOK SCI. TECH. 1969, PP. 227-228, ILLUS.
 THE COMPLEX PROCESSES OF INITIAL INVASION OF TREE
 ROOTLETS ARE SIMILAR FOR BOTH PATHOGENS AND SYMBIOTIC
 FUNGI. HOWEVER, PATHOGENS PREMATURELY DESTROY ROOTLETS,
 AND MYCORRHIZAL FUNGI ARE RESTRICTED TO HARMLESS GROWTH
 AROUND AND WITHIN ROOTLETS. MYCORRHIZAL FUNGI EXTEND
 ROOTLET LIFE BY PHYSIOLOGICAL ACTION AND BY AFFORDING
 PROTECTION FROM PATHOGENS.
- TRAPPE, JAMES M. 09 69131
 STUDIES ON 'CENOCOCCUM GRANIFORME.' I. AN EFFICIENT METHOD
 FOR ISOLATION FROM SCLEROTIA.
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 THIS WIDESPREAD, ANTIBIOTIC-PRODUCING MYCORRHIZAL FUNGUS
 IS VERY DIFFICULT TO ISOLATE FROM TREE ROOT TIPS. HOW-
 EVER, THE READILY GERMINATING, SMALL, BLACK SCLEROTIA
 ARE FORMED ABUNDANTLY IN FOREST SOIL AND EASILY OBTAINED
 AND SURFACE-STERILIZED FOR ISOLATION.
- TRAPPE, JAMES M. 04 69088
 TAXONOMIC STUDIES OF THE EUROPEAN TRUFFLE FUNGI.
 AMER. PHIL. SOC. YEAR BOOK 1968, PP. 339-340.
 THROUGH MYCORRHIZAL ASSOCIATION WITH TREES, THESE FUNGI
 ENHANCE TREE GROWTH. STUDY OF THESE FUNCTIONS HAS BEEN
 IMPEDED BECAUSE OF DIFFICULTY IN IDENTIFICATION. THE
 TAXONOMIC RESEARCH OUTLINED HERE IS LEADING TO A NEW
 WORLDWIDE CLASSIFICATION THAT WILL PERMIT READY IDENTI-
 FICATION OF ALL SPECIES.
- TRAPPE, JAMES M. 02 69026
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- TRAPPE, J. M. 08 69111
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- TRAPPE, JAMES M., AND *STRAND, ROBERT F. 12 69150
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 AND LACKING IN PHOSPHORUS. SEEDLINGS BECAME MYCORRHIZAL
 AND GREW NORMALLY WHEN INOCULATED WITH MYCORRHIZAL SOIL
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AND FRANKLIN, J. F.
NITROGEN ENRICHMENT OF TWO FOREST ECOSYSTEMS BY RED ALDER.
U.S.D.A. FOREST SERV. RES. PAP. PNW-76, 8 PP.
IN A COASTAL OREGON AREA, WHERE SOIL NITROGEN IS PERHAPS
NEAR THE MAXIMUM ATTAINABLE IN A FOREST ENVIRONMENT,
PRESENCE OF RED ALDER LED TO A THREEFOLD INCREASE IN
THE AMOUNT OF NITROGEN CIRCULATING IN LITTERFALL.

SUPPLY AND DEMAND

AUSTIN, JOHN W. 12 69155
LOG EXPORT RESTRICTIONS OF THE WESTERN STATES AND
BRITISH COLUMBIA.
USDA FOREST SERV. RES. PAP. PNW-91, 13 PP.
PRESENTS THE MAIN PROVISIONS OF THE LOG EXPORT
RESTRICTIONS AND PRIMARY MANUFACTURING REQUIREMENTS
FOR TIMBER PRODUCTS OF THE WESTERN STATES AND BRITISH
COLUMBIA.

AUSTIN, JOHN W. 03 69039
PRODUCTION, PRICES, EMPLOYMENT, AND TRADE IN NORTHWEST
FOREST INDUSTRIES, FOURTH QUARTER 1968.
PACIFIC NORTHWEST FOREST AND RANGE EXP. STA., 46 PP.,
ILLUS.
PROVIDES CURRENT INFORMATION ON LUMBER AND PLYWOOD PRO-
DUCTION AND PRICES, EMPLOYMENT IN THE FOREST INDUSTRIES,
INTERNATIONAL TRADE IN LOGS, LUMBER, AND PLYWOOD, VOLUME
AND AVERAGE PRICES OF STUMPAGE SOLD BY PUBLIC AGENCIES,
AND OTHER RELATED ITEMS.

AUSTIN, JOHN W. 06 69082
PRODUCTION, PRICES, EMPLOYMENT, AND TRADE IN NORTHWEST
FOREST INDUSTRIES, FIRST QUARTER 1969.
PACIFIC NORTHWEST FOREST AND RANGE EXP. STA., 40 PP.,
ILLUS.
PROVIDES CURRENT INFORMATION ON LUMBER AND PLYWOOD PRO-
DUCTION AND PRICES, EMPLOYMENT IN THE FOREST INDUSTRIES,
INTERNATIONAL TRADE IN LOGS, LUMBER, AND PLYWOOD, VOLUME
AND AVERAGE PRICES OF STUMPAGE SOLD BY PUBLIC AGENCIES,
AND OTHER RELATED ITEMS.

AUSTIN, JOHN W. 09 69117
PRODUCTION, PRICES, EMPLOYMENT, AND TRADE IN NORTHWEST
FOREST INDUSTRIES, SECOND QUARTER 1969.
PACIFIC NORTHWEST FOREST AND RANGE EXP. STA., 53 PP.,
ILLUS.
PROVIDES CURRENT INFORMATION ON LUMBER AND PLYWOOD PRO-
DUCTION AND PRICES, EMPLOYMENT IN THE FOREST INDUSTRIES,
INTERNATIONAL TRADE IN LOGS, LUMBER, AND PLYWOOD, VOLUME
AND AVERAGE PRICES OF STUMPAGE SOLD BY PUBLIC AGENCIES,
AND OTHER RELATED ITEMS.

AUSTIN, JOHN W. 12 69142
PRODUCTION, PRICES, EMPLOYMENT, AND TRADE IN NORTHWEST
FOREST INDUSTRIES, THIRD QUARTER 1969.
PACIFIC NORTHWEST FOREST AND RANGE EXP. STA., 50 PP.,
ILLUS.
PROVIDES CURRENT INFORMATION ON LUMBER AND PLYWOOD PRO-
DUCTION AND PRICES, EMPLOYMENT IN THE FOREST INDUSTRIES,
INTERNATIONAL TRADE IN LOGS, LUMBER, AND PLYWOOD, VOLUME
AND AVERAGE PRICES OF STUMPAGE SOLD BY PUBLIC AGENCIES,
AND OTHER RELATED ITEMS.

BEUTER, JOHN H. 02 69020
WEBB-POMERENE EXPORT TRADE ASSOCIATIONS AND THE WOOD
PRODUCTS INDUSTRIES OR CAN THE WEBB-POMERENE ACT HELP THE
U.S. SELL MORE PROCESSED WOOD TO JAPAN.
U.S.D.A. FOREST SERV. RES. PAP. PNW-74, 14 PP.
PROVISIONS OF THE WEBB-POMERENE EXPORT TRADE ACT AND ITS
HISTORY OF PERFORMANCE ARE PRESENTED. USE OF THE WEBB
ACT BY WEST COAST WOOD PRODUCTS INDUSTRIES IS DISCUSSED
IN DETAIL. WEBB-POMERENE ASSOCIATIONS SHOULD BE CON-
SIDERED BY FIRMS INTERESTED IN EXPORT TRADE. REQUIRE-
MENTS FOR SUCCESS OF SUCH AN ASSOCIATION ARE DISCUSSED.

*MASSIE, MICHAEL R. C., AND *HARING, ROBERT C. 02 69073
THE FOREST ECONOMY OF HAINEES, ALASKA.
SEG REP. 20, 191 PP., ILLUS. AVAILABLE ONLY FROM INSTI-
TUTE OF SOCIAL, ECONOMIC, AND GOVERNMENT RESEARCH, UNIVER-
SITY OF ALASKA, COLLEGE, AT \$5 PER COPY. (STUDY ACCOM-
PLISHED UNDER COOPERATIVE AGREEMENT WITH INSTITUTE OF
NORTHERN FORESTRY, PACIFIC NORTHWEST FOREST AND RANGE EXP.
STA., FOREST SERV., U.S. DEP. AGR., JUNEAU.)

METCALF, MELVIN E. 01 69068
TIMBER MORTALITY IN WESTERN UNITED STATES SOME FACTS AND
FIGURES AND THEIR MEANING.
IN 'WESTERN FOREST PEST CONDITIONS.' WEST. FOREST. AND
CONSERV. ASS. WEST. FOREST PEST COMM. ANNUAL MEETING
1968, PP. 9-11.
SUMMARIZES MOST RECENT ESTIMATES OF AVERAGE ANNUAL
MORTALITY. RELATES MORTALITY TO INVENTORY, GROWTH, AND
CUT. DISCUSSES HARVEST OF DEAD MATERIAL RELATIVE TO
MORTALITY AND POTENTIAL FOR INCREASE IN SUCH HARVEST.

WALL, BRIAN R. 06 69083
1968 OREGON TIMBER HARVEST.
U.S.D.A. FOREST SERV. RESOURCE BULL. PNW-29, 2 PP., ILLUS.
CHRONICLES TIMBER HARVEST FOR 1950-68 AND GIVES DETAIL
BY COUNTIES FOR 1968.

WALL, BRIAN R. 07 69093
1968 WASHINGTON TIMBER HARVEST.
U.S.D.A. FOREST SERV. RESOURCE BULL. PNW-30, 2 PP., ILLUS.
CHRONICLES TIMBER HARVEST FOR 1950-68 AND GIVES DETAIL
BY COUNTIES FOR 1968.

WALL, BRIAN R. 08 69116
PROJECTED DEVELOPMENTS OF THE TIMBER ECONOMY OF THE
COLUMBIA-NORTH PACIFIC REGION.
USDA FOREST SERV. RES. PAP. PNW-84, 87 PP., ILLUS.
THIS REPORT EXAMINES THE PRESENT FOREST RESOURCE AND
FOREST INDUSTRY IN THE COLUMBIA-NORTH PACIFIC REGION
OF WASHINGTON, OREGON, IDAHO, WESTERN MONTANA, AND
TETON COUNTY, WYOMING. PROJECTIONS OF THE FUTURE WOOD
CONSUMPTION, FOREST EMPLOYMENT, AND PAYROLLS HAVE BEEN
MADE FOR INDUSTRY AND SUBREGIONS TO THE YEAR 2020.

*YOHO, JAMES G., CHAPPELLE, DANIEL E., AND 01 69008
SCHWEITZER, DENNIS L.
THE MARKETING OF RED ALDER PULPWOOD AND SAW LOGS.
U.S.D.A. FOREST SERV. RES. NOTE PNW-96, 7 PP.
IN THE PACIFIC NORTHWEST, RED ALDER HAS INVADDED MANY
CUTOVER AREAS WHICH ONCE SUPPORTED DOUGLAS-FIR. AS THE
SUPPLY OF RED ALDER INCREASED, MORE USES WERE FOUND AND
RED ALDER BECAME MORE VALUABLE. THIS NOTE MEASURES THE
PRESENT RED ALDER RESOURCE AND SUMMARIZES ITS PRODUC-
TION, MARKETING, AND FUTURE PROSPECTS.

TIMBER MANAGEMENT

BARRETT, JAMES W. 04 69057
CROP-TREE THINNING OF PONDEROSA PINE IN THE PACIFIC
NORTHWEST.
U.S.D.A. FOREST SERV. RES. NOTE PNW-100, 13 PP., ILLUS.
THREE PACIFIC NORTHWEST CROP-TREE THINNING STUDIES IN
PONDEROSA PINE SHOWED THAT DIAMETER GROWTH WAS SUBSTAN-
TIALY INCREASED BY CUTTING ALL TREES WITHIN 5 TO 8 FEET
OF THE CROP TREE AND HARVESTING THE MATURE OVERSTORY.

BRIEGLEB, PHILIP A. 01 69070
THROUGH CORRELATED FOREST USE.
IN 'CREATIVE CONSERVATION.' WEST. FOREST. AND CONSERV.
ASS. MEETING PROC. 1968, PP. 20-24.
HIGHLIGHTS VALUES OF VARIOUS FOREST USES, GIVES EXAMPLES
OF CORRELATING SEVERAL USES ON THE SAME AREA, AND PRO-
POSES AN APPROACH TO COORDINATING USES THAT MAY NOT BE
COMPATIBLE ON THE SAME AREA.

*STRAND, ROBERT F., AND MILLER, RICHARD E. 10 69133
DOUGLAS-FIR GROWTH CAN BE INCREASED, REPORT FROM PACIFIC
NORTHWEST SHOWS.
FOREST IND. 96(11), PP. 29-31.
DISCUSSES CURRENTLY AVAILABLE INFORMATION AND RESEARCH
IN PROGRESS. SUGGESTS WORK NEEDED FOR BETTER DECISIONS
ON FOREST FERTILIZATION.

WATER

BERNDT, H. W., AND FOWLER, W. B. 02 69004
RIME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN
WASHINGTON.
J. FOREST. 67, PP. 92-95, ILLUS.
HORIZONTALLY INTERCEPTED MOISTURE--RIME AND HOARFROST--
WAS STUDIED IN A LODGEPOLE PINE STAND. RESULTS SHOW
THAT THIS GENERALLY UNMEASURED SUPPLEMENTAL PRECIPITA-
TION AMOUNTS TO 0.05 TO 0.06 INCH OF MOISTURE EQUIVALENT
PER DAY DURING PERIODS OF ACCUMULATION AND COULD CONTRIB-
UTE AS MUCH AS 3 TO 4 INCHES TOTAL MOISTURE IN AN
ENTIRE WINTER.

FREDRIKSEN, R. L. 12 69175
A BATTERY POWERED PROPORTIONAL STREAM WATER SAMPLER.
WATER RESOURCES RES. 5, PP. 1410-1413, ILLUS.
A PUMPING SAMPLER WAS DESIGNED AND TESTED TO ESTIMATE
MEAN CONCENTRATION OF CONSTITUENTS CARRIED IN STREAM
WATER OVER A PERIOD OF DAYS OR WEEKS. ANNUAL
CONSTITUENT YIELD CAN BE CALCULATED FROM MEAN PERIODIC
CONCENTRATION.

KLOCK, G. O., *BOERSMA, L., *WATTS, D. G., AND 1 69177
*BROOKS, R. H.
DRAINAGE WITH PERFORATED PLASTIC TUBING.
AGRON. J. 61(1), PP. 56-58, ILLUS.
THE FEASIBILITY OF PLACING PERFORATED PLASTIC TUBING
AT SHALLOW DEPTHS AND CLOSE TOGETHER TO IMPROVE
DRAINAGE CONDITIONS ON A PLANCOL IS EVALUATED. (NO
COPIES AVAILABLE)

LEVNO, AL, AND ROTHACHER, JACK. 08 69132
INCREASES IN MAXIMUM STREAM TEMPERATURES AFTER SLASH BURNING
IN A SMALL EXPERIMENTAL WATERSHED.
 USDA FOREST SERV. RES. NOTE PNW-110, 7 PP., ILLUS.
 THE FIRST YEAR AFTER SLASH WAS BURNED ON A 237-ACRE
 CLEARCUT WATERSHED IN THE CASCADE RANGE OF OREGON,
 AVERAGE MAXIMUM WATER TEMPERATURES INCREASED 13 DEGREES,
 14 DEGREES, AND 12 DEGREES F. DURING JUNE, JULY, AND
 AUGUST. A MAXIMUM STREAM TEMPERATURE OF 75 DEGREES F.
 PERSISTED FOR 3 HOURS ON A DAY IN JULY.

LOPUSHINSKY, WILLIAM. 02 69024
A PORTABLE APPARATUS FOR ESTIMATING STOMATAL APERTURE IN
CONIFERS. (ABSTR.)
 NORTHWEST SCI. 43(1), PP. 39-40. (NO COPIES AVAILABLE)

LOPUSHINSKY, WILLIAM. 04 69078
A PORTABLE APPARATUS FOR ESTIMATING STOMATAL APERTURE IN
CONIFERS.
 PACIFIC NORTHWEST FOREST AND RANGE EXP. STA., 7 PP.,
 ILLUS.

THE DESIGN AND USE OF A COMPACT, PORTABLE APPARATUS FOR
 ESTIMATING STOMATAL APERTURE IN CONIFER NEEDLES BY A
 PRESSURE-INFILTRATION METHOD IS DESCRIBED. RESULTS OF
 A TEST WITH DOUGLAS-FIR AND SEVERAL ETHANOL-WATER
 MIXTURES SHOWED THAT A 50- TO 60-PERCENT ETHANOL-IN-
 WATER SOLUTION WAS THE BEST INFILTRATION FLUID. A
 TRANSPIRATION TEST WITH PONDEROSA PINE AND A 57-PERCENT
 ALCOHOL SOLUTION SHOWED THAT THE STOMATA CAN BE CON-
 sidered FULLY OPEN AT AN INFILTRATION PRESSURE OF 10
 P.S.I. OR LESS, AND ESSENTIALLY CLOSED AT 40 P.S.I.

LOPUSHINSKY, WILLIAM. 12 69165
STOMATAL CLOSURE IN CONIFER SEEDLINGS IN RESPONSE TO LEAF
MOISTURE STRESS.

BOT. GAZ. 130, PP. 258-263, ILLUS.
 WATER CONTENT AND MOISTURE STRESS OF FOLIAGE ASSOCIATED
 WITH STOMATAL CLOSURE WERE DETERMINED FOR SEEDLINGS OF
 PONDEROSA PINE, LODGEPOLE PINE, GRAND FIR, DOUGLAS-FIR
 AND ENGELMANN SPRUCE SUBJECTED TO SOIL DROUGHT. IN THE
 FIRS, DECLINE IN TRANSPIRATION WAS ACCOMPANIED BY A
 RELATIVELY SMALL DECREASE IN STOMATAL APERTURE
 SUGGESTING SIGNIFICANT MESOPHYLL RESISTANCE TO
 TRANSPIRATION. AT STOMATAL CLOSURE, THERE WAS LITTLE
 DIFFERENCE BETWEEN SPECIES IN NEEDLE RELATIVE TURGIDITY.
 THE LOWEST TWIG MOISTURE STRESS INDICATED A GREATER
 STOMATAL SENSITIVITY TO INCREASING LEAF MOISTURE STRESS.

MINORE, DON. 07 69166
YELLOW SKUNK-CABBAGE ('LYSICHITUM AMERICANUM' HULT AND ST.
JOHN)--AN INDICATOR OF WATER-TABLE DEPTH.
 ECOLOGY 50, PP. 737-739, ILLUS.

SKUNK-CABBAGE DENSITY AND PETIOLE LENGTH VARY WITH
 AVERAGE WINTER WATER-TABLE DEPTHS IN COASTAL OREGON.
 SLOUGH SEDGE ('CAREX OBNUPTA' BAIL.) GROWS WITH SKUNK-
 CABBAGE WHERE WINTER WATER TABLES ARE ABOVE THE SOIL
 SURFACE.

WOOD UTILIZATION

ANONYMOUS. 05 69089
CENTER'S JESUP WOOD COLLECTION FEATURED ON RADIO.
 THE CENTERPIECE, WEST. FOREST. CENTER NEWSLETTER, PP. 1-2,
 ILLUS. (QUOTED FROM RADIO TALK GIVEN BY CHARLES J.
 NEWLON, NO COPIES AVAILABLE)

BOLLEN, W. B., AND LU, K. C. 08 69128
DOUGLAS-FIR BARK TANNIN DECOMPOSITION IN TWO FOREST SOILS.
 USDA FOREST SERV. RES. PAP. PNW-85, 12 PP., ILLUS.
 PURIFIED DOUGLAS-FIR BARK TANNIN EQUIVALENT TO THE
 AMOUNT IN A 2-INCH BARK MULCH WAS ADDED TO TWO WIDELY
 DIFFERENT SOILS IN THE LABORATORY. ABOUT 22 PERCENT OF
 THE TANNIN DECOMPOSED IN 180 DAYS. SOIL MICROFLORA
 GENERALLY INCREASED. NITRATE PRODUCTION WAS SLIGHTLY
 DECREASED IN THE PRESENCE OF TANNINS. DOUGLAS-FIR BARK
 ADDED TO SOIL APPEARS HARMLESS FROM THE STANDPOINT OF
 ITS TANNIN CONTENT.

BOLLEN, W. B. 02 69096
PROPERTIES OF TREE BARKS IN RELATION TO THEIR AGRICULTURAL
UTILIZATION.

U.S.D.A. FOREST SERV. RES. PAP. PNW-77, 36 PP., ILLUS.
 MILLIONS OF TONS OF TREE BARK ARE PRODUCED ANNUALLY BY
 THE WOOD PRODUCTS INDUSTRY OF THE PACIFIC NORTHWEST.
 MOST OF THIS MATERIAL IS DISPOSED OF BY BURNING WHICH
 CREATES A MAJOR SOURCE OF AIR POLLUTION. PHYSICAL AND
 CHEMICAL PROPERTIES OF THE BARK OF MAJOR TREE SPECIES
 OF THE PACIFIC NORTHWEST SUIT THIS MATERIAL WELL FOR
 AGRICULTURAL USES--MULCHING, SOIL CONDITIONING, DRAIN-
 AGE IMPROVEMENT, ANIMAL BEDDING, ETC.

*EMERY, A. F., AND CARSON, W. W. 12 69157
EVALUATION OF USE OF THE FINITE ELEMENT METHOD IN
COMPUTATION OF TEMPERATURE.
 AMER. SOC. MECH. ENG. PAP. NO. 69-WA/HT-38, 9 PP.,
 ILLUS. (COPIES AVAILABLE ONLY FROM THE AMERICAN
 SOCIETY OF MECHANICAL ENGINEERS, 345 E. 47TH ST.,
 NEW YORK, N.Y. 10017)

HALL, J. ALFRED. 09 69141
THE PULP AND PAPER INDUSTRY AND THE NORTHWEST.
 PACIFIC NORTHWEST FOREST AND RANGE EXP. STA., 61 PP.
 THE PULP AND PAPER INDUSTRY OF OREGON AND WASHINGTON IS
 OF GREAT ECONOMIC IMPORTANCE. IT AMOUNTS TO ABOUT 15
 PERCENT OF NATIONAL PRODUCTION AND A SUBSTANTIAL PART OF
 THE TOTAL ECONOMY OF THE NORTHWEST.
 PROBLEMS OF WATER AND AIR POLLUTION ARE BEING ATTACKED
 SUCCESSFULLY AND, WITHIN TECHNOLOGICAL LIMITATIONS,
 SOLVED.
 RAW MATERIAL SUPPLIES FOR PROSPECTIVE DOUBLING OF
 CAPACITY DEPEND UPON BETTER USE OF LOGGING WASTE, IM-
 PROVED MANAGEMENT OF SECOND-GROWTH STANDS, AND USE OF
 UNUSED SPECIES.

HEEBINK, T. B. 05 69087
THE FIELD MEASUREMENT OF SOUND INSULATION.
 SOUND AND VIBRATION. VOL. 3(5), PP. 18-22, ILLUS.
 A RESEARCH TEAM IN SEATTLE, WASHINGTON, STUDYING SOUND
 INSULATION OF APARTMENT WALLS AND FLOORS, HAS DEVELOPED
 A SUCCESSFUL METHOD OF TEMPORARILY SHIELDING THE SPECI-
 MEN AS REQUIRED BY THE AMERICAN SOCIETY OF TESTING AND
 MATERIALS. THE SHIELDS DEVELOPED ARE PORTABLE, REUSA-
 BLE, AND EFFECTIVE WITHOUT DEFACING OR MARRING THE
 WALLS OR CEILINGS.

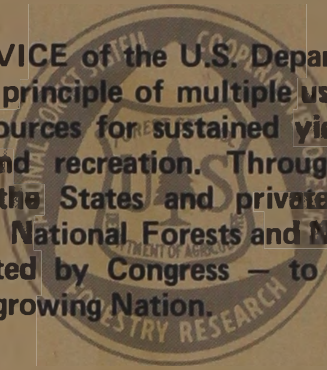
HEEBINK, TOM B., AND *ALLOUCHE, E. G. 02 69031
A LABORATORY DETERMINATION OF SOUND TRANSMISSION CLASSES
FOR ELEVEN PARTY WALL CONSTRUCTIONS.
 SIMPSON TIMBER CO. RES. DEP. REP. 149, 27 PP. PLUS
 APPENDIX, ILLUS. (COPIES AVAILABLE ONLY FROM SIMPSON
 TIMBER CO., RESEARCH CENTER, REDMOND, WASH.)
 THE SOUND INSULATION PROPERTIES OF 11 WOOD-FRAMED WALL
 CONSTRUCTIONS WERE EVALUATED IN AN ACOUSTICS LABORATORY.
 SEVERAL VARIABLES WERE INCLUDED, MOST OF WHICH INVOLVED
 1/2-INCH SOUND DEADENING BOARD.
 WHEN GYPSUM WALLBOARD WAS ATTACHED TO THE 1/2-INCH SOUND
 DEADENING BOARD WITH VERTICAL BEADS OF ADHESIVE, MIDWAY
 BETWEEN STUDS, OR WITH 6-INCH STRIPES OF ADHESIVE AROUND
 THE PERIMETER OF THE GYPSUM PANELS, RESULTS WERE ABOUT
 EQUAL AND WERE CONSIDERABLY BETTER THAN ORDINARY
 NAILING.

KNUTSON, DONALD M. 02 69023
A TECHNIQUE FOR ESTIMATING RELATIVE NUMBERS OF BACTERIA IN
WOOD SAMPLES. (ABSTR.)
 NORTHWEST SCI. 43(1), P. 38. (NO COPIES AVAILABLE)

PACIFIC NORTHWEST FOREST AND RANGE EXP. STA. 01 69006
POCKET GUIDE TO THE IMPROVED GRADING SYSTEM FOR PONDEROSA
PINE AND SUGAR PINE SAW LOGS IN TREES.

52 PP., ILLUS.
 (ORIGINAL PUBLICATION WAS AUTHORED BY EDWARD M. GAINES
 AND PUBLISHED IN 1964 BY PACIFIC SOUTHWEST FOREST AND
 RANGE EXP. STA., BERKELEY, CALIF. THIS 1969 EDITION IS
 REPRINTED WITH NO CHANGE IN TEXT.)

WOODFIN, RICHARD O., JR. 01 69001
SPIRAL GRAIN PATTERNS IN COAST DOUGLAS-FIR.
 FOREST PROD. J. 19, PP. 53-60, ILLUS.
 SPIRAL GRAIN MEASUREMENTS WERE MADE ON VENEER SAMPLES
 FROM 1,845 DOUGLAS-FIR PEELER BLOCKS. THE PREDOMINANT
 SPIRAL GRAIN PATTERNS WERE IDENTIFIED.



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